

The copy filmed here has been reproduced thanks to the generosity of:

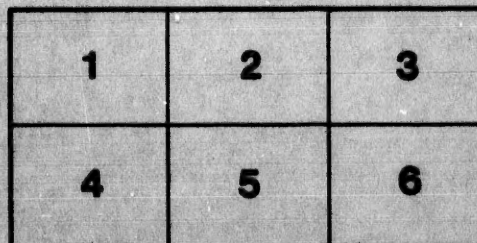
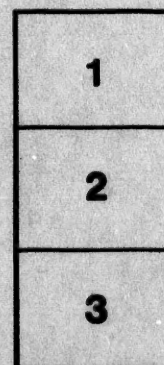
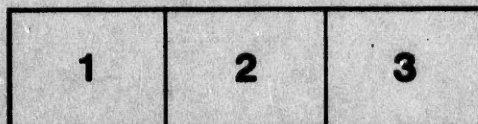
Library,
National Museums of Canada

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol ➡ (meaning "CONTINUED"), or the symbol ▼ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

Bibliothèque
Musées Nationaux du Canada

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole ➡ signifie "A SUIVRE", le symbole ▼ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.

Henry
and se
with ap
fortune -
as s
lawful

ART ANATOMY OF ANIMALS

Wash. D.C. July 30-1935

I hereby certify that this copy after being condemned
and set aside by the Central High School Library was
with approval of Mr Smith, Principal, taken for the
future use of young students

as such it is now presented to and is the
lawful property of John W. Tennant.

Robert S. Roberts
Director in Chief

National Forward-to-the-Land Assn. Inc.

AR



NATURAL

STUDIES IN THE ART ANATOMY OF ANIMALS

BEING A BRIEF ANALYSIS OF THE VISIBLE FORMS OF THE MORE
FAMILIAR MAMMALS AND BIRDS. DESIGNED FOR THE
USE OF SCULPTORS, PAINTERS, ILLUSTRATORS,
NATURALISTS, AND TAXIDERMISTS.

BY

ERNEST E. SETON THOMPSON

NATURALIST TO THE GOVERNMENT OF MANITOBA; AUTHOR OF "THE BIRDS OF MANITOBA," "THE MAMMALS OF MANITOBA,"
"THE KING OF CURRUPAW." *EXPOSANT AU SALON.*

ILLUSTRATED WITH ONE HUNDRED DRAWINGS BY THE AUTHOR



LIBRARY
NATIONAL MUSEUM

London

MACMILLAN AND CO., LTD.

NEW YORK: THE MACMILLAN CO.

1896.

006022

WHO I

TO MY LIFE-LONG FRIEND
MRS. C. M. B. SCHREIBER,
WHO FIRST DIRECTED MY ATTENTION TO THE STUDY OF ART ANATOMY,
THIS VOLUME IS
Affectionately Dedicated.

THERE ha
There have been
imals, but no

The vario
somewhat circu
e surgical or
ject of study
erburdened v

I have en
orking always
med to inculc
ring with it
atomical stud

I have ma
hat this is the
the artist, an
nscientious Ja
Birds may s
pen of Mr.

ressly for an

The plates,
ections or fi

The same
uld give a fre
as far as p
lts in occas
sider the na
y descriptive

PREFACE

THERE has hitherto been no general work on the Anatomy of Animals from the Art standpoint. There have been several treatises on the Anatomy of the Horse and one or two on others of the domesticated animals, but no work presenting the general principles of Comparative Anatomy applied to Art.

The various special works existent cannot be said to answer the present purpose even within their somewhat circumscribed limits. All are open to serious objection. Either they were written entirely from the surgical or zoological standpoint, and internal structure rather than external form made the chief object of study; or the subject is treated obviously with the dead animal only in view; or they are overburdened with text and in most cases poorly illustrated.

I have endeavoured to advance a step by treating primarily the *visible form of the living animal*; working always with the living subject before me as well as a dead one on the dissecting table. I have aimed to inculcate general principles by treating in detail a familiar and typical species, the Dog, comparing with it all animals commonly represented by the painter and sculptor and supplementing the anatomical studies of each by series of actual and proportional measurements.

I have made a careful study of Hair, or Fur, from the scientific as well as the artistic point of view. That this is the first attempt ever made to study the subject is surprising in view of its great importance to the artist, an importance which will scarcely be questioned after an examination of the works of the unscientific Japanese or the best modern masters of animal sculpture. The section on the Art Anatomy of Birds may also claim to be unique, for although antedated by the full and valuable papers from the pen of Mr. Goodchild, this is the first time that the subject has been treated in a publication designed expressly for artists.

The plates, which are the chief feature of this work, are from original drawings made from my own dissections or from nature.

The same anatomical names are used for all the species treated, as I cannot understand why anatomists should give a fresh set of names to the muscles for each new animal—surely it is better to retain through-
out, as far as possible, the familiar nomenclature of the human subject. It is maintained that this results in occasional absurdities in view of the meaning of the terms, but it seems to me preferable to consider the names merely as handles to the facts, as abstract symbols; for if we admit the right to a purely descriptive name the nomenclature must continue to change as long as human opinion changes.

Among the books referred to, the most useful were Ellenberger and Baum's "Anatomie des Hundes," and the anatomical works of Chauveau, Mivart, and Cuyer and Alix. A list of the principal works consulted is appended.

My thanks are due to Dr. John Caven, of Toronto Medical School, and to Dr. A. Primrose, of Toronto Biological School, for assistance in making my dissections as well as for placing at my disposal the material and appliances in their laboratories; to Professor Filhol, of the Museum d'Histoire Naturelle, for putting at my service the skeletons in the Galerie d'Anatomie Comparée; and to Professor Ed. Cuyer for assisting me with the material in the Museum of the École des Beaux Arts in Paris.

I am also indebted in an especial degree to Mr. William Anderson, F.R.C.S., Professor of Anatomy at the Royal Academy of Arts, London, for assistance in matters bibliographical, and for a revision of the text, particularly of the chapters relating to the bones and muscles; and to Miss Grace Gallatin, of New York, for essential aid in the literary revision of the work, and for putting the manuscript in due form for the printer.

ERNEST E. THOMPSON.

PARIS,
August 1895.

INTRODU

CHAPT

- I.
- II.
- III.
- IV.
- V.
- VI.
- VII.
- VIII.
- IX.
- X.
- XI.
- XII.
- XIII.
- XIV.
- XV.
- XVI.
- XVII.
- XVIII.
- XIX.
- XX.
- XXI.
- XXII.
- XXIII.
- XXIV.
- XXV.
- XXVI.
- XXVII.
- XXVIII.
- XXIX.

anatomie des
the principal

. Primrose, of
at my disposal
sire Naturelle,
Professor Ed.
ris.

of Anatomy
a revision of
race Gallatin,
manuscript in

THOMPSON.

TABLE OF CONTENTS

	PAGE
INTRODUCTION	1
CHAPTER	
I. GENERAL CONSIDERATIONS	3
II. THE HAIR	4
III. THE SKIN-FOLDS	7
IV. THE NERVES	8
V. THE GLANDS	9
VI. THE VEINS	10
VII. THE FASCIAE, LIGAMENTS AND TENDONS	11
VIII. THE BONES	12
IX. THE MUSCLES OF THE DOG	15
X. THE MUSCLES OF THE DOG (<i>continued</i>)	18
XI. THE MUSCLES OF THE DOG (<i>continued</i>)	22
XII. THE MUSCLES OF THE DOG (<i>continued</i>)	26
XIII. THE MUSCLES OF THE DOG (<i>continued</i>)	30
XIV. THE SIZE AND PROPORTIONS OF THE DOG	31
XV. THE ANATOMY, SIZE, AND PROPORTIONS OF THE WOLF	33
XVI. THE FOX	35
XVII. THE ANATOMY, SIZE, AND PROPORTIONS OF THE CAT	36
XVIII. THE ANATOMY, SIZE, AND PROPORTIONS OF THE LION	37
XIX. THE ANATOMY, SIZE, AND PROPORTIONS OF THE TIGER	39
XX. THE JAGUAR	41
XXI. THE LEOPARD	42
XXII. THE COUGAR, PUMA, PANTHER OR MOUNTAIN LION	43
XXIII. THE CHITA, CHEETAH OR HUNTING LEOPARD	44
XXIV. THE BEAR FAMILY	45
XXV. THE GRIZZLY BEAR	46
XXVI. THE EUROPEAN BROWN BEAR	47
XXVII. THE AMERICAN BLACK BEAR... ..	48
XXVIII. THE POLAR OR WHITE BEAR... ..	49
XXIX. THE ANATOMY OF THE HORSE	50

TABLE OF CONTENTS

CHAPTER	PAGE
XXX. THE SIZE AND PROPORTIONS OF THE HORSE	52
XXXI. THE ASS OR DONKEY	55
XXXII. THE ANATOMY, SIZE, AND PROPORTIONS OF THE OX	56
XXXIII. THE AMERICAN BUFFALO OR BISON	58
XXXIV. THE SHEEP	60
XXXV. THE BIGHORN	61
XXXVI. POLO'S OR THE PAMIR SHEEP	62
XXXVII. THE GOAT	63
XXXVIII. THE GIRAFFE	64
XXXIX. THE PRONG-HORNED ANTELOPE	65
XL. THE DEER FAMILY	66
XLI. THE WAPITI OR AMERICAN ELK	67
XLII. THE RED DEER OF EUROPE	68
XLIII. THE VIRGINIAN DEER OR COMMON DEER OF AMERICA	69
XLIV. THE MOOSE AND THE EUROPEAN ELK	70
XLV. THE REINDEER AND THE CARIBOU	72
XLVI. THE CAMEL AND THE DROMEDARY	73
XLVII. THE PIG	74
XLVIII. THE INDIAN ELEPHANT	75
XLIX. THE AFRICAN ELEPHANT	77
L. MEASUREMENTS OF CERTAIN SKELETONS	78
LI. THE HORSE IN MOTION	80
LII. THE GALLOP OF THE DOG	81
LIII. THE ANATOMY OF BIRDS	82
LIV. THE PEACOCK	85
A LIST OF THE PRINCIPAL WORKS CONSULTED	86
INDEX	89

PLATE

I. I

II. I

III. T

IV. F

V. T

VI. T

VII. T

VIII. T

IX. T

X. T

XI. T

XII. T

XIII. T

XIV. T

XV. T

XVI. T

XVII. T

XVIII. T

XIX. T

XX. T

XXI. T

XXII. T

XXIII. T

XXIV. T

XXV. T

XXVI. T

XXVII. T

XXVIII. T

XXIX. T

...	...	52
...	...	55
...	...	56
...	...	58
...	...	60
...	...	61
...	...	62
...	...	63
...	...	64
...	...	65
...	...	66
...	...	67
...	...	68
...	...	69
...	...	70
...	...	72
...	...	73
...	...	74
...	...	75
...	...	77
...	...	78
...	...	80
...	...	81
...	...	82
...	...	85
...	...	86
...	...	89

LIST OF PLATES

PLATE	
I.	DIAGRAM OF A WOLF
II.	DIAGRAM OF THE HAIR ON THE BELLIES OF DOG AND CAT
III.	THE ARRANGEMENT OF HAIR ON THE GREYHOUND
IV.	HEADS OF LYNX, AMERICAN BUFFALO, AND LION
V.	THE ANATOMY OF THE GREYHOUND. THE SKELETON
VI.	THE ANATOMY OF THE GREYHOUND. THE BONE POINTS
VII.	THE ANATOMY OF THE GREYHOUND. SOME DETAILS OF THE BONES, AND THE FIRST LAYER OF MUSCLES
VIII.	THE ANATOMY OF THE GREYHOUND. THE IMPORTANT MUSCLES
IX.	THE ANATOMY OF THE GREYHOUND. BACK AND FRONT VIEWS OF THE SKELETON AND THE IMPORTANT MUSCLES
X.	THE ANATOMY OF THE GREYHOUND. THE SKELETON AND THE IMPORTANT MUSCLES SEEN FROM ABOVE
XI.	THE ANATOMY OF THE GREYHOUND. THE SKULL
XII.	THE ANATOMY OF THE GREYHOUND. THE MUSCLES, &C., OF THE HEAD
XIII.	THE ANATOMY OF THE GREYHOUND. THE MUSCLES OF THE THIRD LAYER
XIV.	THE ANATOMY OF THE GREYHOUND. THE DEEPER MUSCLES OF THE TRUNK AND THIGH
XV.	THE ANATOMY OF THE GREYHOUND. THE DEEPEST MUSCLES OF THE TRUNK
XVI.	THE ANATOMY OF THE GREYHOUND. INNER SIDE OF FORELIMB AND UNDER SIDE OF CHEST
XVII.	THE ANATOMY OF THE GREYHOUND. EXTERIOR OF FORELIMB
XVIII.	THE ANATOMY OF THE GREYHOUND. INNER SIDE OF LEFT FORELIMB
XIX.	THE ANATOMY OF THE GREYHOUND. THE BONES AND MUSCLES OF THE LEFT FORE FOOT
XX.	THE ANATOMY OF THE GREYHOUND. INNER SIDE OF LEFT HIND LEG
XXI.	THE ANATOMY OF THE GREYHOUND. THE BONES AND MUSCLES OF THE LEFT HIND FOOT
XXII.	THE ANATOMY OF THE GREYHOUND. THE BONES AND MUSCLES OF THE PELVIS AND TAIL
XXIII.	THE ANATOMY OF THE GREYHOUND. SECTIONS OF TRUNK AND LIMBS
XXIV.	THE PROPORTIONS OF A TYPICAL DOG AND WOLF
XXV.	THE ANATOMY OF THE CAT (ALSO OF LION, TIGER, PANTHER, ETC.)
XXVI.	THE SKELETON OF THE LION
XXVII.	THE PROPORTIONS OF THE LION
XXVIII.	THE ANATOMY OF THE HORSE. THE SKELETON
XXIX.	THE ANATOMY OF THE HORSE. THE IMPORTANT MUSCLES

PLATE

- XXX. THE ANATOMY OF THE HORSE. FRONT VIEW OF THE SKELETON AND THE IMPORTANT MUSCLES
- XXXI. THE ANATOMY OF THE HORSE. BACK VIEW OF THE SKELETON AND THE IMPORTANT MUSCLES
- XXXII. THE ANATOMY OF THE HORSE. SECTIONS OF THE NECK, CHEST AND FORELIMB
- XXXIII. THE ANATOMY OF THE HORSE. SECTIONS OF THE TRUNK AND HINDLIMB
- XXXIV. THE PROPORTIONS OF A TYPICAL HORSE
- XXXV. THE ANATOMY OF THE OX
- XXXVI. THE PROPORTIONS OF THE OX
- XXXVII. THE PROPORTIONS OF THE SHEEP
- XXXVIII. THE PROPORTIONS OF THE DROMEDARY AND THE CAMEL
- XXXIX. THE HORSE IN MOTION. THE WALK AND THE AMBLE
- XL. THE HORSE IN MOTION. THE TROT AND THE RACK
- XLI. THE HORSE IN MOTION. THE CANTER AND THE GALLOP
- XLII. ATTITUDES OF A HOUND RUNNING
- XLIII. THE COMMON HOUSE OR EUROPEAN SPARROW (*Passer domesticus*)
- XLIV. THE ANATOMY OF THE COMMON OR HOUSE SPARROW
- XLV. THE EUROPEAN KESTREL (*Falco alaudarius*). FEMALE
- XLVI. UPPER SURFACE OF LEFT WING OF EUROPEAN KESTREL
- XLVII. THE ANATOMY OF THE COMMON QUAIL OF EUROPE (*Coturnix communis*)
- XLVIII. UPPER SURFACE OF LEFT WING OF COMMON QUAIL OF EUROPE
- XLIX. THE PLAN OF A PEACOCK'S TRAIN

We h
for artists.
considered
and muscles
knowledge.

The a
indispensab
must contin
painter, the

There
Anatomy p
students of
entering it

In like
animal pain
has never b
living men,
farther than
but exactly
endeavours
display.

The f
Barye mon
shows how

'The com
recording the
proportions, en
his work agree

'It was th
is beneath the
to those who s
'If one v
arrangement, is

INTRODUCTION

WE have not yet reached the point where it is no longer necessary to defend the study of Anatomy for artists. Art Anatomy of the human form has had many advocates; the argument that they have considered quite satisfactory being,—the artist *can* draw the human form without a knowledge of its bones and muscles, but he does it much better, and much more quickly and surely, when equipped with such knowledge.

The argument for the Art Anatomy of Animals is yet stronger,—the knowledge of it is absolutely indispensable. The figure-painter always can pose his models, and paint what he sees. The *animalier* must continually work from knowledge of the form, his models never pose, and, unlike those of the figure-painter, they are invariably *au naturel*.

There is no more convincing argument than the practice of the masters. The advocates of Human Anatomy point with pride to Michael Angelo, Leonardo da Vinci, and Raphael, who were profound students of surgical anatomy, as well as great lights of art. They were, in fact, pioneers in this field, entering it with a view to advancing their art.

In like manner the *animalier* may find guidance—and guidance even less equivocal—in the history of animal painters and sculptors. There have been great *genre* painters who did not study Anatomy, but there has never been a famous *animalier* who did not. Barye, Landseer, Gericault, Méne, Cain, as well as the living men, with one voice send the student to the study of Anatomy. Some of them would carry the study farther than others, but all are agreed in carrying it far, in grasping the subject thoroughly and broadly, but exactly. And yet, contradictory as it may seem, they all unite in warning the artist, that he who endeavours to make a display of his anatomical knowledge is as surely lost as though he had none to display.

The following extract from the address delivered by M. Eug. Guillaume at the inauguration of the Barye monument, gives an excellent idea of the methods pursued by the great sculptor of animals, and shows how he made use of anatomy in a manner that was at once broad and of the utmost exactness :—

‘The composition once decided upon, Barye, compass in hand, measured the skeletons of the animals which he was about to model, recording the dimensions with the most scrupulous care, and incorporating them in his work; and, unless the bones, in their relative proportions, entered exactly into the frame of his *maquette*, he changed the latter, and never declared himself satisfied until he had made his work agree exactly with the proportions of the species he had undertaken to represent.

‘It was thus that Barye arrived at perfection. His works give the lie direct to those theories which would make us believe that it is beneath the dignity of art to seek the aid of exact knowledge, or to have recourse to methods of precision; they are at least a rebuke to those who say that to proceed in this way is to divest art of its spontaneity, its ideality, and its life.* * * *

‘If one were to ask me now what is, in my opinion, the master trait of the great artist, I should say strength. This, with arrangement, is the quality that he never fails to emphasize. At a time when there are so many enervated minds, when we are tossed

about by changing aspirations, when by a sort of depraved dilettantism, one willingly styles oneself decadent, or again, to be more exactly in *fin de siècle* conditions, one is pleased, in the art world, by an affectation of languor and vapidty,—it is indeed good to exalt and do honour to vigour in an artist of incontestable renown, for this is the sovereign and incomparable quality of the works of Barye.’

To this Professor Ed. Cuyer adds :—

‘In brief, these admirable embodiments of strength and suppleness were executed at the cost of a labour as scientific as it was incessant. The drawings as well as the casts that we possess at the Museum of Anatomy at the Ecole des Beaux Arts effectually establish this. They explain also why one of his biographers wrote,—“Barye simply turned on his heel when he heard it said that science is fatal to the imagination.”’

Professor Anderson of the Royal Academy, in his address before the British Medical Association on Art in its relation to Anatomy, makes the following very apposite remarks :—

‘It is not the knowledge but the misuse of the knowledge that is dangerous, and there is no doubt that the pride of Michael Angelo in his anatomical attainments led him to neglect that close study of the living model, which had given perfection to the work of Pheidias; hence it is that the critic who is dumb before the old Greek may feel compelled to temper his admiration of the Florentine with a regret that so great a mind should have stopped short of the highest goal.

‘That Pheidias attained consummation in Art, without scientific education, proves only that there is no law for the highest genius; the writings of Shakespeare do not tower above rivalry because he knew “small Latin and less Greek,” but because with Pheidias, and, perhaps, a dozen other men in the world’s history, he rose far above all theories of education. Setting apart such men as these, the greatest artist in art or literature will always express best what he best understands. The wise man is he who knows not merely a fact, but the meaning of the fact, and Science will not fail to stimulate and guide observation when not weakened by admixture with an overweening pride in itself.’

The question has been raised as to whether the study of Anatomy is synonymous with dissection. Some writers consider that dissection is the sole means to a knowledge of the subject. I am inclined to the belief that the artist who works in the dissecting room, over ground already well known, is not using his time to the best advantage. He should rather avoid the dead animal and the surgical point of view. There is no doubt that one obtains a more thorough knowledge of the construction by dissecting, but it is unnecessarily thorough. It is of much greater importance that the student should model from the living animal, using as guides the best anatomical diagrams obtainable, bearing in mind however that Anatomy is like a virulent poison—when judiciously administered it is a powerful stimulant to art, but in an overdose it is death. This is especially true in painting; one sees but little of Anatomy in the living animal except in silhouette; and he who makes it of prime importance, produces mere diagrams, and loses sight of the greater essentials of light, colour, and movement.

ART A
of those par
bones and n
teeth, claws
anatomists
even the ve

In dep
artist than

Mammals n

All M

of the same
obscured by
through the
anatomist, i
is admirably
readily obta

Natura
that this co

Before

In all dep

and the hair

Wolf, or L

ART ANATOMY OF ANIMALS

CHAPTER I.

GENERAL CONSIDERATIONS.

ART ANATOMY is a scientific explanation of the *visible living form*, or, in other words, it is the study of those parts of a living animal which influence its outward form or its expression. Besides the principal bones and muscles, this includes tendons, cartilages, sinew-sheaths, external veins and nerves, folds of skin, teeth, claws, beak, hoofs, horns, bristles, hair, feathers, &c.; and although it has been the custom of art anatomists to treat only of the first two mentioned, it will be seen that in many animals, the hair, and even the veins, are of far greater importance than many of the muscles or minor bones.

In depicting Birds also, a knowledge of the feathering is, generally speaking, of more value to the artist than familiarity with the separate muscles and bones. But a sound knowledge of the form of Mammals must be founded on an acquaintance with the bony skeleton and muscular system.

All Mammals are built on the same general plan; even the human form is but a slight variation of the same. All however are not equally good for study; some are poorly developed, some have the form obscured by wool, or by fat, some are too unwieldy or too minute, and others are not obtainable for study, through their rarity. But the Greyhound will be found well adapted to the requirements of the art anatomist, in his initial study of bones and muscles. It is superbly developed and the relation of its parts is admirably displayed through the fine skin and thin coat. It is neither too large nor too small, it is readily obtained almost anywhere, and when alive is perhaps easier to study than any other animal.

Natural sequence requires that the hairy coat be first treated or dissected. And it will be seen that this course is not entirely without justification in the importance of the subject.

Before proceeding further it will be well to give a word of warning regarding individual variation. In all departments of anatomy great allowance must be made for this, but especially in the muscles and the hair. It is probable, indeed, that the variations between a typical Dog and a typical Cat, Fox, Wolf, or Lion, &c., are not greater than those which will be found existing between different Dogs.

CHAPTER II.

THE HAIR.

Plates I., II., III., IV.

It is remarkable that the study of the Hair should have been so long and so entirely ignored. In all animals that bear it, it is of interest and value, in most it is of equal importance with the muscles, in many it is of much more consequence than these, ranking in value next to the bones as an element of form.

In the Horse, or the Greyhound, we see the hairy coat at a minimum, and yet in these the Hair has much to do with their appearance. In a Wolf the hair-masses are at least of equal importance with the muscles, and in a Grizzly, or Brown Bear, in its winter coat, the hair-masses and the bones give the clue to nearly all the visible form. In a Barye statue of a bear now before me it is impossible to detect the form of a single muscle, except on the arm. All the rest of the detail is worked out in hair-masses.

In very small Mammals the turn of the Hair is almost the only clue to the form, and the peculiar rounding and cracking on ham and on shoulder are the only indications of the complicated machinery of bones and muscles which lies far beneath.

The Greyhound has too scanty a covering to be a good subject for an initial study of Hair, so the Common Wolf (*Canis lupus*) will be used instead. This animal, practically the same throughout North America, Europe, and Northern Asia, is really a Wild Dog, with the best possible development of a Dog's powers. Its coat illustrates admirably all the essential features of furry covering, features which, though discoverable in the Greyhound, are in that animal so reduced as to be difficult of study.

The Hair of the Wolf and of most Mammals is of two kinds; a fine wool next the skin, and an outer covering of long, nearly straight hairs growing through this. The first retains the heat, and the second repels the rain. The first predominates on the lower and the second on the upper parts of the body.

The wool is also better than the hair for such parts as are very supple and change much in form, consequently we see a predominance of wool in those areas of loose or sliding skin under which the body has great play.

This may be due to the wearing off of the longer, brittle hair. The wool on these sliding areas is seen to crack open when the skin is extended. These peculiar tracts are so much more the result of arrangement than of actual change in the fur, that it is impossible to distinguish them in the animal after it is skinned or long dead; but no one can look at the living, moving creature and doubt their importance from a picturesque point of view.

These areas are limited in the Wolf, but in the Puma, or American Panther, we see them at a maximum, and the wonderful suppleness of this animal is aptly illustrated by the fact that its body is almost everywhere clad in this particular kind of covering.

The leg
very hard.
the same tim

In gen
least possibl
motion. (Th
dead deer w
grain.') Se
first law giv

But th
The first im
the way for
tribes, a nota
hair on the
(See Plates

On the
the softer co
where they

This m
probable cau

The e
discarded as
which we m
the side of t
This may be
the surround
useless circ

There
these radiati
the front vie

To exp
The sk
At these cer
the upper la
traverses the
hair which
are the poi
Scars.

The r
The protect
leg is horiz
account for

On the
hind-legs a
the 'milk-r
This has be
the amount
is not comp

The legs, shoulders, and face of the Wolf are covered by a variety of hair which is short, close and very hard. This is well calculated to give to the limbs and the senses perfect freedom of action, and at the same time is readily kept clear of mud, remnants of food, &c.

In general, the direction of the Hair is determined by two laws. First, the necessity of offering the least possible resistance to the air, and to grass, brushwood and other obstacles, while the animal is in motion. (This may be illustrated by the well-known fact that the hunter can readily drag, nose first, a dead deer which, heels first, he could scarcely move, for the obvious reason that it would be 'against the grain.') Second, the necessity for running off the rain, especially while the animal is lying at rest. The first law gives a backward, and the second a downward direction to the Hair.

But these rules are much broken by local requirements of more force, as will be seen in the Wolf. The first important exception is the curious radiation of the hair about the eye, with the object of clearing the way for the sight. This divergence is well shown in the American Buffalo; and among the feathered tribes, a notable parallel case is seen in the Owls. The hair of this radiation, meeting the counter-current of hair on the nose, produces the little ridge which is such a marked feature on the face of all hairy animals. (See Plates I., II., and III.)

On the side of the throat is a patch of reversed hair; it lies between the great thatch of the neck and the softer covering of the throat; it also covers the triangle between the upper and lower maxillary veins where they join the jugular.

This may be clearly seen in the Greyhound. (See Plate III.) After discussing with Dr. Caven the probable cause of this disturbance, we concluded that its history was briefly as follows:—

The early aquatic ancestor of living Mammals breathed by means of gills, which were gradually discarded as the creature became a land animal, and breathed by means of the elaborated air bladder, which we now call lungs. But with that conservatism so well known in organic bodies, the gill-cleft in the side of the neck persisted for long afterwards, and with it the accompanying circumvolution of the veins. This may be detected in the mammalian fœtus, and when finally the old scar heals up, the disturbance in the surrounding hair is still to be seen, and in not a few cases the blood vessels preserve traces of the now useless circumvolutions.

There is a centre of divergence on the inside of each arm, as shown in Plate II., and the meeting of these radiations with the descending hair of the chest causes the ridges that are such a marked feature of the front view. (See Plate III.)

To explain these arrangements, I can suggest only the following theory.

The skin is formed from centres of pellification, just as the bone is formed from centres of ossification. At these centres the lowest layers are first formed, and in them the hair bulbs. The minute structures of the upper layer, having a tendency to push farther from the centre, would naturally give to the hair which traverses them, but which is fixed at its lower end, a tendency to diverge from the centre. The ridges of hair which appear as lines of convergence are the natural corollaries of the centres of divergence, they are the points where meet the two areas of independently formed skin, and may be styled Structural Scars.

The reversion of the hair on the back of the fore-legs may perhaps be explained in another way. The protection accorded by its position frees it from the operation of the first law; and the fact that the leg is horizontal when the animal is lying down would give the second law full force and reasonably account for its direction.

On the ischiatic bones we have radiating centres like those on the fore-arms, and on the inside of the hind-legs are reversed parts of the coat, as on the fore-legs. In Cows this area of reversed hair is called the 'milk-mirror,' as its extent is known to correspond with the amount of milk given by the animal. This has been explained on the ground that the direction of the Hair is determined by the main veins, and the amount of milk has, of course, a direct connection with the blood supply. This explanation, however, is not complete or satisfactory, even though one finds in other parts of the animal a remarkable coincidence

between the presence of superficial blood vessels and of disturbance in the Hair-arrangement. These radiations are all remarkably clear in the Greyhound.

Plate I. shows how the Wolf illustrates the foregoing principles. The drawing is understood to be diagrammatic, as the disposition of fur therein shown, though more or less discernible in all Wolves, will but rarely be found as clear and sharp as in the drawing.

The chief masses are :—

The ruff, beginning before the ears, and passing over the back of the jaw and under the throat ; this is much better developed in the Lynx and the Lion (*Plate IV.*).

The curious little cushion under each ear, a sort of central point or whorl of the several hair currents of the region.

The great thatch or mane of coarse hair ; much developed in the Lion.

The soft woolly part under the throat meeting the mane ; these two coincide nearly with the two parts of the *Panniculus cervicis*.

The mane along the shoulders, and the smaller crest on the top or dorsal edge of each scapula.

The patch of sliding fur behind each shoulder, and the corresponding patch on each flank, before the hind-leg, showing the great play of the limbs.

The two areas of reversed hair on the breast.

The fringe of reversed hair on the back of each fore-leg.

The great cushion of wool on each of the buttocks.

The tail, clad entirely in the sliding fur, except the slight thatch on the base above.

The ridges on the chest and on the belly, apparently structural scars as already defined.

The correlation of colour with this arrangement is striking.

The heavy thatches are much mixed with black hair ; the thatch on the base of the tail is usually ended in a dark spot ; the ruff on the cheeks is always paler in colour than the hair on the crown and neck ; the sliding fur is always paler than the hair about it ; while the close fur on the limbs and face is usually darker than elsewhere.

This arrangement both of form and of colour will be seen in all Dogs, Wolves, Jackals, and Foxes, and in a general sense is common to all the Carnivora ; the leading features are to be found in all hairy quadrupeds, as well as in man himself. From this it will be seen that, excepting on the shoulder, the fore-leg, and the hind-leg below the knee, these anatomical details of the hairy coat are in the Wolf, as well as in many other animals, of more importance than the anatomy of the muscles.

In man
much more
find several
First, t
the muscula
Second
Nearly
peculiar arra
Third,
front of the
several Pac
throat.

gement. These

understood to be
all Wolves, will

nder the throat ;

the several hair

ly with the two

ach scapula.

ach flank, before

ned.

he tail is usually
n the crown and
limbs and face is

s, and Foxes, and
ound in all hairy
the shoulder, the
in the Wolf, as

CHAPTER III.

THE SKIN FOLDS.

Plate VII.

IN many animals the Folds of Skin are of consequence. In the Rhinoceros for instance they are of much more importance than any of the individual muscles. In the present example, the Greyhound, we find several of these loose flaps, which though greatly reduced are still of value in picturesque effect.

First, the fold from the back of the arm to the ribs, that is, the roof of the armpit formed in part of the muscular fibres of the Flyshaker or *Panniculus carnosus*.

Second, the fold from the knee to the belly, forming the groin-flap or loose-flank.

Nearly all quadrupeds have this and the first well marked, and usually they are distinguished by a peculiar arrangement of hair.

Third, two loose folds on the throat arising one from each ramus of the lower jaw, uniting on the front of the neck. These are excessive in the Bloodhound and kindred races, as well as in Bulls and several Pachyderms. Their object apparently is to give free play to the neck and protection to the throat.

CHAPTER IV.

THE NERVES.

Plate XII.

ALMOST the only Nerves we need to observe are those whose terminations are enlarged bosses on the skin in which are long specialised bristles, feelers or whiskers.

In the Dog we find these in four places on each side of the head, and in two places on the lower jaw:—

Ends of the Infraorbital Nerves, or Whisker-bed. This is the great nerve-bed at each side of the muzzle, out of which, in the Dog, grow the whiskers in four rows.

Malar, a small boss with four or five bristles.

Zygomatic, a smaller boss on the cheek above and behind the preceding—in the Greyhound with but few bristles.

Frontal, over the inner corner of each eye.

The Mental, on the lower surface of the end of the Lower Jaw; more or less provided with bristles.

Mylo-hyoid, a conspicuous boss with long bristles; it is situated on the inter-ramal space beneath the lower jaw.

There is also a noticeable cord crossing the hough space; this is formed by a nerve and a vein lying side by side, and is strongly marked in the Greyhound.

Some animals, as the Squirrels, have nerve-endings and bristles on the inner surface of the fore-legs.

These organs act as feelers of exquisite sensibility. They are usually most developed in the strictly nocturnal quadrupeds, and in those whose mode of life necessitates an absolutely silent course through the woods, when their eyes can avail but little. In such the bristles usually project the width of the body on each side of the head.

LYMPH
notice are
Saliva

Lymph

There
animals, su

CHAPTER V.

THE GLANDS.

Plates VIII., XII.

LYMPH and Salivary Glands appear as rounded bosses in several parts of the Dog. Those claiming notice are the following:—

Salivary.

- Parotid.
- Submaxillary.
- Buccalis.

Lymph.

- Pre-auricular.
- Cervical or superficial lymphatic glands of the throat, in three pairs.
- Thyroid, a deep set of glands showing between the jugular vein and the trachea.
- Suprascapular, in three parts under the cephalo-humeral and angularis muscles.

There are many other larger glands, but they are too deep-set to influence the visible form. In other animals, such as the Goats and Deer, the glands are more numerous and important than in the Dog.

CHAPTER VI.

THE VEINS.

Plates VIII., XII., XIII., XVI., XX.

THE Veins are in many instances more important than the muscles. They are largest and most marked when the animal is alive and in action. In the dead animal they are inconspicuous, and in the skinned subject they must be sought for. This no doubt accounts for their having been ignored so long. Yet the great *facial* and *angular* veins are among the most marked features of the face in the Dog, Horse, Deer, &c. They are discernible even in the human face when the individual is thin or aged. Contrary to the usual rule, the overlying skin, instead of hiding the large external veins, seems rather to add to their prominence.

The important Veins of the Dog are as follows:—

Facial with its tributaries,

Coronary,

Angularis,

Dorso-nasal.

Temporal with its facial tributaries, not visible in the living Dog,

Internal Maxillary, uniting with the temporal and maxillary to form on the neck

The Jugular, a very large vein, though not always visible.

Brachial, uniting in the front of the arm with the

Subcutaneous Basilic Vein to form the

Cephalic.

Ulnar, a tributary of the brachial.

Great Saphenous, this is the conspicuous vein that crosses the hough; its branches are seen on the back, front, and inner side of the hinder limb.

THE
allied to
often giv
perceptible
The

In th
definite bo
following:

Tendo
appearing a

CHAPTER VII.

THE FASCIÆ, LIGAMENTS AND TENDONS.

Plates VIII., XIX., XXI.

THE whole body is more or less covered with a thin fibrous expansion called Fascia. This is allied to tendon in its structure, but forms broad planes ensheathing the muscles and tendons and often giving attachment to muscular fibres. Its direct influence on the visible form is not very perceptible, although it is anatomically very important.

The only Fasciæ we need note are as follows:—

Lumbo-dorsal, covering the loins.

Ventral, on the belly.

Fascia Lata, one of the most important, covering the outer side of the thigh, also called the Vagina Femoris.

Femoral, on the inside of the thigh.

Tibial or Crural, enveloping the leg. It is the chief insertion of the biceps.

In their nature Ligaments are similar to Fasciæ, but are thicker and narrower, with more definite boundaries and purposes. While every joint has its ligaments we need mention only the following:—

Ligamentum nuchæ, a very powerful and elastic structure connecting the occiput and cervical vertebræ; it supports the head.

Greater and Lesser Sacro-sciatic Ligaments, between the sacrum and the ischium.

Ligamentum patellæ from the lower part of the patella to the crest of the tibia,—really the tendon of the quadriceps extensor, and not a ligament.

Annular Ligaments, to retain the tendons at the lower joints of the limbs as shown on plates.

Tendons or Sinews are composed of thick cords of material similar to that of the ligaments but appearing as parts of a muscle, in which connection the important ones are considered.

CHAPTER VIII.

THE BONES.

Plates V., VI., IX., X., XXI.

IT is not necessary to describe in detail each of the Bones. The plates give a sufficient idea of their individual characters as well as their general relations. A few remarks on special points and on the skeleton as a whole will be of most service.

While some fair-sized Bones, such as the Vomer, Palatine, Ethmoid, &c., are of little or no importance to the artist, some of the smallest, as the Pisiform and Calcaneum, are of cardinal interest. This of course is due to the latter being next the skin, through which they form prominent points of the visible anatomy.

It is necessary to know these places of Bone contact with the skin, as they are fixed points whose position is mathematically ascertainable and from which all the rest of the anatomy may be accurately determined and drawn.

The following is a classified list of the bony prominences of the Dog :—

THE HEAD.

Plates VI., XI.

Occipital Tuberosity, Lambdoid Crest, and the Superior Curved Lines or Occipital Crest across the back of the head.

Sagittal or Interparietal Crest—at right angles to the lambdoid.

Internal Angular, or Orbital Process of the Frontal Bone, making the prominent ridge on the inner corner of the eye.

Orbital Process of Malar Bone, much less prominent, but readily discernible at the outer corner of the eye.

Nasal Bones. These present a large rounded surface rather than a point.

Alveolar Ridge of the Premolars, on the upper jaw or maxillary.

Alveolar Ridge or Eminence of the Canines, on the upper jaw or maxillary, much hidden by the whisker-bed.

Zygomatic Arch—from the orbit to the ear.

The Superciliary Frontal or Semilunar Ridges, over the eyes meeting in V shape on the forehead.

The V
prominent

The N
Neura
Neura
and the res
Curves
Lower
cartilages.
Manul
feature of t

Tuber
Crest
Keel

Dorsal
Spine
Acrom
Coraco
Head
Olecr
Extern
Capite
Intern

in that regio
Pisiform
importance.
Intern
Tuber
Scapho
below the

Trapez
Head
Pyram
Uncifo
Head
Heads

THE NECK.

Plates VI., VII., X.

The Wings of the Atlas or First Cervical Vertebra, though not quite reaching the skin, are sufficiently prominent to make marked external protuberances.

THE BODY.

Plates V., VII., IX., X.

The Neural Spines of all the (13) Dorsal Vertebrae, especially where clear of the trapezius.

Neural Spines of all the (7) Lumbar Vertebrae.

Neural Spines of the Caudal Vertebrae, the first or that next the sacrum being the most prominent, and the rest less so in regular succession.

Curves or Bends of seven or more Ribs.

Lower Ends of seven or more Ribs, that is, the slight projections where the ribs unite with the costal cartilages.

Manubrium or Presternum, the prominent point of the breast bone or sternum; it forms a leading feature of the front view.

Tuberosities of the Ischium, one on each buttock.

Crest of the Ilium, or Hip Bone, a very important projection.

Keel of Sacrum, at the back upper part of the pelvis.

THE FORE-LEG.

Plates V., VI., IX., X., XIX.

Dorsal Edge of Scapula.

Spine of Scapula, showing as a groove in the living animal.

Acromion, the prominent outward point of the shoulder.

Coracoid Process, discernible but not prominent over the head of the humerus.

Head of Humerus, the prominent forward point of the shoulder.

Olecranon Process, or Point of Elbow, one of the most important bony projections.

External Epicondyle of Humerus, at the exterior of the elbow joint.

Capitellum or Head of Radius, just below the preceding.

Internal Epicondyle of Humerus, a prominent point on the inner side of the elbow joint, the only one in that region, as the head of the radius does not show on the inner side.

Pisiform, or Supercarpal, a small bone projecting from the back of the wrist. It is of cardinal importance.

Internal Malleolus of Radius, the prominent feature of the inner side of the wrist joint.

Tuberosity of Radius, in front, not very important.

Scapho-lunar, below the preceding, sometimes appearing also as a second slight boss in front below the radius.

Trapezium, below the preceding.

Head of the First Metacarpal, the lowest prominence on the inner side of the wrist.

Pyramidal, the prominent boss on the outside of the wrist joint.

Unciform, before and nearly on a level with the preceding—not very prominent.

Head of the Fifth Metacarpal, the strongest feature on the outer side of the wrist.

Heads of the Fourth and Third Metacarpals, forming protuberances in front below the carpus.

Sesamoids, small bones set in pairs, one pair under the end of each metacarpal.
The Knuckles or Joints of the Phalanges.

THE HIND-LEG.

Plates V., VI., IX., X., XXI.

Great Trochanter of Femur, a very strong feature.

External Tuberosity or Epicondyle of Femur, on the outside of the knee.

Head of the Fibula, below the preceding.

Patella or Knee-cap, the small bone that lies in front of the femur at the knee-joint.

Internal Tuberosity or Epicondyle of Femur, on inner side of knee.

Internal Tuberosity of Tibia, below the preceding.

Tuberosity or Crest of Tibia, projecting from the fore part of the tibial head. It is the prominent feature of the knee in profile.

External Malleolus, the tuberosity on the lower end of the fibula.

Internal Malleolus, the lower tuberosity of the tibia on the inner side of the hough.

Os calcis or Calcaneum, the heel bone, the great feature of the hough.

External Process of Calcaneum, a prominence on the outer side of the hough.

Cuboid, under the preceding, very variable.

Head or Tuberosity of External Metatarsal, the strongest feature of the lower and outer side of the hough.

Navicular or Scaphoid, the tuberosity of this bone is prominent on the inner side of the hough just below the internal malleolus.

Head or Tuberosity of the Internal Metatarsal, the most pronounced projection on the inner side of the joint.

Tuberosities of the Two Internal Metatarsals show in front.

Sesamoids, minute bones corresponding with those of the carpus.

The Knuckles or Joints of the Phalanges are the remaining bony protuberances.

NOTE.
the form, and

Immed
envelop nea
must be car

PANNI
under the sk
run oblique
form, at the
muscle, at i
an auxiliary

PANNI
and uniting
and move
A small slip
the ' Watch

There
eed be stud
a classified
some of t

CHAPTER IX.

THE MUSCLES OF THE DOG.

NOTE.—In the following descriptive catalogue, those muscles which influence visibly and individually the form, and are perceptible in the living Greyhound, are in heavy-faced type.

THE MUSCLES OF THE SKIN.

Plate VII.

Immediately underlying the skin, and adhering to it strongly, are two very thin sheets of muscle that envelop nearly the whole surface of the trunk. They have but little influence on the visible form, and must be carefully removed before a clear view of the important muscles can be obtained. These are :—

PANNICULUS CARNEUS, or Flyshaker. A great thin sheet of muscular fibres covering the body under the skin. Its action is to move the skin, and its attachments are chiefly to it. But its fibres, which run obliquely downwards and forwards, leave the trunk at two places, and become definite elements of form, at the groin where they are the muscular basis of the loose flank, and behind the shoulder where this muscle, at its thickest, forms the roof of the arm-pit, and uniting with the latissimus it becomes apparently an auxiliary of that great muscle. Excepting at these two places it is of little consequence to the artist.

PANNICULUS CERVICIS (*Platysma myoides*). In two parts, upper and lower, the upper covering the neck and uniting on the face and throat with the lower. Its action is to draw back the lips, shake the skin and move the ears. It is no thicker than a sheet of paper, and is of no consequence to the artist. A small slip of this is attached to the front of the ear; as it draws the ear forward it has been called the 'Watching Muscle.'

THE MUSCLES OF THE HEAD.

There are about forty muscles in a Dog's head, but not more than a fourth of these are important, or need be studied individually, for it is only as a mass that they influence the visible form. The following is a classified list of these muscles. Those on the muzzle, lower jaw and hyoid region are briefly described, some of them are distinguishable in the living animal.

THE MUSCLES OF THE MOUTH AND CHEEK.

Plates VII., VIII., X., XII.

I have failed to detect the individual form of any but four of these in the living Dog, but the complex mass surrounding the mouth is peculiar in shape and is important.

RISORIVS (*Risorius Santorini*).

ZYGOMATICUS MAJOR, running from the malar bone to the angle of the mouth.

Levator labii superioris alæque nasi (*Maxillaris*). This may be detected in the living animal on careful examination.

MALARIS OR ZYGOMATICUS MINOR, an unimportant auxiliary of the preceding. It is closely related to the *lachrymalis* of Hoofed Animals.

Levator labii superioris proprius (*Nasalis longus*), discernible on careful examination. This and the preceding are parts of the *Quadratus labii superioris*.

Levator anguli oris (*Caninus*). This may be discovered on careful examination.

INCISIVI, minute fibres connecting the orbicularis with the gums.

BUCCINATOR. This is divided into two parts, the *molaris* and the *buccalis*.

ORBICULARIS ORIS (*Sphincter oris*, *Labialis*), surrounding the mouth.

DEPRESSOR LABII INFERIORIS (*Quadratus labii inferioris*, *Maxillo-labial*).

THE MUSCLES OF THE EYELIDS.

Plate XII.

None but the first of these is individually discernible in the living animal, but the corrugations of the skin that they cause are very marked.

ORBICULARIS PALPEBRARUM, surrounding the opening of the eye.

LEVATOR PALPEBRÆ SUPERIORIS, a minute and deep-lying muscle that raises the upper eyelid.

CORRUGATOR SUPERCILIARIS MEDIALIS, or inner frowning muscle.

CORRUGATOR SUPERCILIARIS LATERALIS, or outer frowning muscle.

The eyeball itself is held in place and moved by seven unimportant small muscles within the socket; four *Recti*, two *Obliqui*, and a *Choanoid* or *Retractor*.

THE AURICULAR SHEET OR THE MUSCLES OF THE OUTER EAR AND SCALP.

Plates VII., VIII., X., XII.

Authorities differ greatly in their treatment of the thin but complex sheet of fibres that surrounds the base of the ear and causes the movements of that organ. None of the divisions or recognised muscles are discernible in the living animal, and in the dead they readily escape the notice of the dissector.

SCUTULARIS, subdivided into three parts, *intermedius*, *frontalis*, and *cervicalis*.

ATTOLLENS (*Auricularis superior*, *Levator auris medius*).

ATTRAHENS (*Auricularis anterior*). This muscle is divided into three parts, *superior*, *median* and *inferior*.

RETRAHENS (*Auricularis posterior*, *Cervico-auricularis*, *Occipito-auricularis*). This is subdivided into *longus*, *brevis* and *levator*.

PAROTIDEUS (*Depressor conchæ*, *Parotideo-auricularis*).

ROTATOR (*Scutulo-auricularis inferior*, or *internus*).

There are also several minute unimportant muscles connected with the cartilage of the ear; these are *Transversus*, *Helicis*, *Antitragicus*, *Tragicus major*, and *Tragicus minor*.

EPICRANIUS (*Occipitalis*). This is a thin sheet of fibre that moves the scalp.

THE MUSCLES OF THE LOWER JAW.

Plates VIII., XII.

Masseter. This is a very prominent muscle: it is divided into three layers or parts, which however need not be considered separately. Origin: zygomatic arch and malar bone. Insertion: into the concave outer surface of the ascending ramus of the lower jaw. Action: to raise the lower jaw and close the mouth.

Temporalis. Origin: on the side of the skull and from the bony crest bounding the temporal fossa or great space between the temporal bone and the zygoma; it fills this fossa. Insertion: the coronoid process and anterior border of ramus of lower jaw. Action: to close the mouth by raising the lower jaw.

Pterygoideus internus and externus. This is within the jaws; it is in two parts, the internal and external. Origin: the first, on the inside of the pterygoid bone which is in the back of the palate behind the palatine bone. Insertion: the hollow or inner face of ramus of lower jaw. Origin of the external part: on the outer side of pterygoid and surrounding bones. Insertion: the neck of the mandibular condyle. Action: to raise the jaw.

THE MUSCLES OF THE TONGUE AND THROAT.

Plates VIII., IX., X., XII., XVI., XXIII.

Digastricus (*Biventer maxillæ inferioris*). Origin: styloid process of the occipital bone. Insertion: one part into the posterior border of lower jaw, the other part into the internal face of same. Action: to depress the lower jaw and to open the mouth.

STYLO-HYOID. Origin: styloid process of the temporal bone and auditory bulla. Insertion: the base of the lesser cornu of the hyoid bone. Action: to draw the hyoid bones backward and upward.

MYLO-HYOID. Origin: on the inner side of the mandible. Insertion: the body of the hyoid. Action: to support or raise the tongue and the hyoid bone.

GENIO-HYOID. Origin: inside the lower mandible at the symphysis or chin suture. Insertion: the body of the hyoid. Action: to draw the hyoid forward.

STERNO-THYROID. Origin: inner surface of presternum or manubrium. Insertion: thyroid cartilage of larynx. May be perceived in some dogs while alive.

THYRO-HYOID. This is a sort of continuation of the last. Origin: thyroid cartilage. Insertion: the greater cornu of the hyoid bone.

STERNO-HYOID. Origin: inner surface of manubrium anterior to the sterno-thyroid. Insertion: the body of hyoid bone. Action: this, with the foregoing two, draws back the hyoid, &c.

STYLO-GLOSSUS. A large muscle arising from the styloid process of temporal bone, and passing into the tongue. It is the edge of the tongue. This and the following two are obviously of little importance.

HYO-GLOSSUS (*Basio-glossus*). A flat muscle from the body and cornua of the hyoid bone to the side of the tongue.

GENIO-GLOSSUS. A flat muscle from the under side of the tongue to the thyro-hyal.

Lingualis, longitudinal fibres, extending the length of the tongue, divided into *superficial* and *deep*. This forms the body of the tongue.

Closely related to the foregoing are seven pairs of very small deep-lying muscles that act upon the pharynx and soft palate, and yet other seven pairs which move the larynx.

CHAPTER X.

THE MUSCLES OF THE DOG (*continued*).

THE DEEP-LYING MUSCLES OF THE NECK.

Plates XIII, XIV., XV., XXIII.

THE following twelve muscles influence the form as a mass only, and therefore need not be studied in detail. In the subject they are very complicated and subject to much variation. The first four may be grouped together as parts of the *Prevertebral Mass*, and the remaining eight as parts of the *Erector colli* or *Postvertebral Mass*. Omitting the last two, the whole group has been styled the *Capital Muscles*.

LONGUS COLLI. Origin: from the first six dorsal vertebræ under the neck to all the cervical vertebræ but the first two or three. Insertion: the under side of atlas. Action: to curve the whole neck downwards.

COMPLEXUS MINOR (*Longissimus capitis, Trachelo-mastoideus, Transversalis capitis*). Origin: first four dorsal and last three or four cervical vertebræ. Insertion: mastoid process. A separate slip on the under side of this is attached to the wing of the atlas, and has been called the *Longus atlantis*. Action: to incline or bend the head.

RECTUS CAPITIS ANTICUS MAJOR (*Longus capitis*). Origin: transverse processes of all but the first and last cervical vertebræ. Insertion: under side of occipital bone. Action: to bend the head down or to one side.

RECTUS CAPITIS ANTICUS MINOR. Origin: the atlas. Insertion: under side of occipital bone. Action: to aid the foregoing.

RECTUS CAPITIS POSTICUS MAJOR. Origin: neural spine of axis. Insertion: occiput. Action: to raise the head.

RECTUS CAPITIS POSTICUS MINOR. Origin: the atlas. Insertion: occiput below preceding. Action: to lift the head.

RECTUS CAPITIS POSTICUS MEDIUS, closely related to the two foregoing.

RECTUS LATERALIS. Origin: wing of the atlas. Insertion: styloid process and surrounding portion of skull. Action: to turn the head.

OBLIQUUS INFERIORIS, a large muscle. Origin: neural spine of axis. Insertion: wings of the atlas. Action: to turn the atlas on the axis.

OBLIQUUS SUPERIORIS, a small muscle. Origin: transverse process of atlas. Insertion: the mastoid region. Action: to turn the head.

TRANSVERSO-SPINALIS CERVICIS, a continuation on the neck of the multifidus.

INTERTRANSVERSALIS, small muscles between the transverse processes of the vertebræ of the neck. Action: to incline the neck to one side.

The
the living
Splen
on the for
as fifth dor
into the tr
Comp
the *Semispi*
occiput.
Long
first four o
the transve

Erect
whole spin
it. I have
separate for
important
spinales, Int
on the exte
muscle und
Longi
erector spin
long horizo
Insertion: t
verse proces
XIV., XV.,
Spinal
and is there
from the sac
Action: the
Ilio-co
longissimus
the two pre
SERRAT
py muscular
XIII., XIV.
SERRAT
vertebræ. I
n expiration
Serrat
importance,

THE MUSCLES OF THE NECK.

Plates VIII., XIII., XIV., XV., XXIII.

The following, though really belonging to the foregoing group, are more superficial, and are visible in the living animal. The first belongs to the Prevertebral group, and the other two to the Erector group.

Splenius (*Spino-transversalis*). This large muscle, with the preceding, has an important influence on the form of the neck. It is in two parts, *S. capitis* and *S. colli*. Origin: all along the neck and as far as fifth dorsal vertebra from the neural spines. Insertion: with the little complexus into the mastoid, and into the transverse processes of the upper cervical vertebræ. Action: to extend or incline the head.

Complexus major, a large and important muscle. Its upper part is sometimes treated separately as the *Semispinalis*. Origin: the last six cervical vertebræ, and the dorsal vertebræ as far as fourth. Insertion: occiput. Action: to extend the head or bend it to one side.

Longissimus cervicis (*Cervicalis descendens, Transversus cervicis*). Origin: on the spines of the first four or five thoracic vertebræ and on the longissimus dorsi, of which it is a continuation. Insertion: the transverse processes of the four or five last cervical vertebræ. Action: to raise the head and neck.

THE MUSCLES OF THE TRUNK.

Erector spinæ. This very large and complex mass of fibres involves the dorsal surface of the whole spinal column. If we consider it as one muscle, the following three must be looked on as parts of it. I have, however, treated them separately because they appear on the surface and as well-marked separate forms. Most of the authorities treat it as a number of closely related muscles, of which the most important parts, in addition to these three, are:—*Semispinalis, Multifidus spinæ, Rotatores spinæ Inter-spinales, Intertransversales*. But as the whole mass of these latter is so deeply seated as to have no influence on the external form, excepting as a mass, it may be well for the sake of simplicity to reckon them as one muscle under the above name. (Plates X., XIII., XIV., XV., XXIII.)

Longissimus dorsi (*Long Dorsal, Ilio-spinalis*). This large and important muscle is a part of the erector spinæ, it is especially noticeable in the loins, where, with the ilio-costalis and spinalis, it forms the long horizontal mass above the hollow of the flank. Origin: anterior margin of ilium and sacrum. Insertion: the seventh cervical vertebra, and also to all the thoracic and lumbar vertebræ by their transverse processes, and to the ribs. Action: to extend the spine or bend it to one side. (Plates X., XIII., XIV., XV., XXIII.)

Spinalis (*Spinalis dorsi et cervicis* or *colli*). This is but the inner part of the longissimus dorsi, and is therefore part of the erector spinæ. Origin: chiefly in the last dorsal and the lumbar vertebræ and from the sacrum. Insertion: the spinous processes of all the thoracic and cervical vertebræ except the atlas. Action: the same as that of the longissimus. (Plates XIII., XIV., XV.)

Ilio-costalis (*Sacro-lumbalis*). This is part of the erector spinæ. Origin: ilium and sacrum and the longissimus dorsi. Insertion: the seventh cervical vertebra and by a tendon to each rib. Action: to assist the two preceding and to aid in expiration. (Plates XIII., XIV., XV., XXIII.)

SERRATUS ANTICUS (*Serratus posticus superior*). Origin: by fascia from the spinal column. Insertion: by muscular digitations into each rib from second to tenth. Action: to lift the rib in inspiration. (Plates XIII., XIV., XXIII.)

SERRATUS POSTICUS (*Serratus posticus inferior*). Origin: by fascia from the foremost lumbar vertebræ. Insertion: into thirteenth, twelfth, eleventh, and tenth ribs. Action: to draw down these ribs in expiration. (Plate XIII.)

Serratus magnus (*Serratus anticus major*). This, though not a superficial muscle, is of great importance, as its large and peculiar form is always well marked on the living animal, but much more so

in the Cat tribe than in Dogs or Hoofed animals. Its cervical part is sometimes described separately as the *Levator anguli scapulae*. Origin: by digitations from the first seven ribs and the last five cervical vertebræ. Insertion: the vertebral margin of the scapula. Action: to raise the trunk between the shoulders and the ribs in inspiration. (Plates XIII., XIV., XXIII.)

LEVATORES COSTARUM, small groups of fibres. Origin: dorsal transverse processes, passing obliquely backward to their insertion in the ribs. Action: to raise the ribs in inspiration. (Plate XXIII.)

INTERCOSTALES. These are fibres in two layers, *external* and *internal*, connecting the ribs, one, the outer, directed downwards and backwards; the other, the inner, the reverse way. Action: in breathing. (Plates VIII., XIII., XIV., XV., XXIII.)

STERNALIS (*Transversus costarum*). Origin: anterior end of rectus abdominis close to the sternum at the third and fourth costal cartilages. Insertion: first rib just below insertion of scalenus. Action: an inspirator. (Plates XIII., XIV., XXIII.)

TRIANGULARIS STERNI. Origin: inside of sternum. Insertion: cartilages of the ribs. Action: an expirator. It is within the chest, and therefore not important to the artist.

Rectus abdominis. Origin: on the pubic bone. Insertion: into the xiphoid cartilage by muscular fibres and into the cartilages of the first five or six ribs by a tendon; its muscle fibre ceases at the ninth rib, in front of this it is a narrow, ribbon-like tendon. Action: it is the principal flexor of the spine. (Plates VIII., XIII., XIV., XV., XVI., XXIII.)

Obliquus abdominis externus (*Great Oblique*). The lower edge of the fleshy part of this muscle forms the prominent ridge along the side of the hound. Origin: from the eight or nine hindermost ribs and the lumbar fascia. Insertion: the ilium, pubic bone and the fascia of the loin and groin. Action: in expiration or to flex the spine, or incline it laterally. (Plates VIII., XVI., XXIII.)

Obliquus abdominis internus (*Small Oblique*). Origin: this lies under the preceding, and its fibres cross those of the great oblique nearly at right angles: it arises from the lumbar fascia and the ventral margin of the ilium and the pubic bone. Insertion: on the back end of the last rib and cartilages of the hindmost ribs. Action: to assist the preceding. (Plates XIII., XXIII.)

TRANSVERSALIS ABDOMINIS. Origin: this is the deepest of the abdominal muscles, its fibres are nearly perpendicular; it arises from the cartilages of the ribs behind the diaphragm, and from the lumbar transverse processes. Insertion: the fibres extend downwards into an aponeurosis which unites with the rectus. Action: it forms a kind of elastic and contractile belt to support or compress the bowels. (Plates XIV., XXIII.)

The *Diaphragm*, and the minute muscles styled the *Inguinal* and *Preputial*, are omitted here, the first being entirely internal, and the others quite insignificant.

QUADRATUS LUMBORUM. This is within the abdominal cavity, and therefore not important. Origin: the inner face of two or three last ribs and most of the processes of the lumbar vertebræ on their under side. Insertion: chiefly on the ilium. Action: a flexor of the spine. (Plates XXII., XXIII.)

SCALENUS in two or sometimes three distinct parts, *anticus*, *medius*, and *posticus*. Origin: cervical vertebræ, chiefly the fifth. Insertion: on the ribs as far as the sixth near the sternum and by a tendon reaching as far as the ninth rib. Action: to draw the ribs forward and so expand the chest. This muscle is more important in the Cat than in the Dog, because in the former it is seen on the ribs farther behind the shoulder. (Plates VIII., XIII., XIV., XXIII.)

Trapezius. An important sheet of muscle in two parts. *Fore part*, origin: fascia in the middle of the neck and back as far as the middle of the scapula. Insertion: the spine of the scapula. *Hind part*, origin: spines of the dorsal vertebræ. Insertion: upper third of spine of scapula. Action: to raise the shoulder, or to carry it forward or backward. (Plates VIII., IX., X., XXIII.)

Angularis (*Levator scapulae ventralis*). This has been called a ribbon of the trapezius. Origin: the atlas. Insertion: the acromion. Action: to lift the lower end of the scapula. (Plates VIII., IX., XXIII.)

separately as the
cervical vertebræ.
shoulders and the

processes, passing
(Plate XXIII.)
the ribs, one, the
in breathing.

to the sternum
mus. Action: an

the ribs. Action:

ilage by muscular
at the ninth rib,
the spine. (Plates

shy part of this
the eight or nine
fascia of the loin
II., XVI., XXIII.)
ceding, and its
bar fascia and the
of the last rib and
II.)

its fibres are nearly
from the lumbar
ch unites with the
press the bowels.

itted here, the first

re not important.
vertebræ on their
XII., XXIII.)

Origin: cervical
y a tendon reaching
his muscle is more
farther behind the

fascia in the middle
the scapula. *Hind*
Action: to raise

of the trapezius
ula. (Plates VIII.,

RHOMBOIDEUS, in two parts, *dorsal* and *nuchal*. Origin: neural spines of six hinder cervical, and six or seven anterior dorsal vertebræ: a thin separate ribbon of this is inserted into the lambdoid ridge, and has been described as the *Levator scapulæ dorsalis*. Insertion of both parts, the vertebral margin of scapula. Action: to draw the shoulder upwards or backwards. (Plate XIII.)

Cephalo-humeral, consisting of two parts, a great thin variable sheet originating in the fascia behind the head; and a thick band of muscle under the first, originating on the mastoid process by a tendon. These two unite near the shoulder, on what is known as the clavicular tendon, because it marks the place where the clavicle bone ought to be, and are inserted into the lower end of the humerus around the fascia of the shoulder joint. Action: to advance the limb or to draw the limb and the head together. (Plates VIII., IX., X., XVI., XXIII.)

Mastoideus, or **Sterno-Mastoid**. This is more or less united with the preceding, sometimes they are described together as the *Sterno-cleido-mastoid*, or *Mastoido-humeralis*. Origin: the manubrium. Insertion: the mastoid process and also by fibres to the fascia of the occiput. Action: to depress the head. (Plates VIII., IX., X., XVI., XXIII.)

Latissimus dorsi (*Great Dorsal*), a large and important muscle. Origin: neural spines of vertebræ from the sixth dorsal, the fascia investing the loins and the last two or three ribs. Insertion: its tendon blending with that of the teres major and with the panniculus inserted into the humerus inside below the tuberosity, and also into the fascia enveloping the arm. Action: supports the arm and carries the trunk forward, &c. (Plates VIII., X., XXIII.)

Pectoralis superficialis or **major**. A large and important muscle in two layers, a forward and a transverse. Origin: the manubrium and attachments of first four costal cartilages. Insertion: on and under the lesser tuberosity half-way down the humerus. Action: to adduct, flex and rotate inwards the fore-limb. (Plates VIII., IX., XIII., XVI., XXIII.)

Pectoralis profundus or **minor**, a large and important muscle, much disposed to split up into bundles, one for each part of the sternum. Origin: on the sternum from the xiphoid cartilage to the second rib. Insertion: to the inner tuberosity of the humerus. Action: to draw the shoulder downwards and backwards, and move the arm backward. (Plates VIII., IX., XIII., XVI., XXIII.)

CHAPTER XI.

THE MUSCLES OF THE DOG (*continued*).

THE MUSCLES OF THE SHOULDER.

Plates VII., VIII., IX., X., XIII., XVI., XXIII.

MOST muscles have more than one function. Many of the foregoing, though classed as muscles of the trunk, bear also on the limbs, &c.; the last nine should perhaps be considered as muscles of the fore-limb rather than of the trunk. The following are strictly muscles of the fore-limb.

Deltoid (*Abductor brachii*), in two portions. *Scapular part*, origin: spine of the scapula and surrounding aponeurosis. *Acromion part*, origin: acromion and adjacent parts of scapula. Insertion of both: the deltoid ridge on the outside of humerus. Action: to flex the shoulder joint and rotate the humerus outwards.

Supraspinatus. Origin: the whole surface of the front part of the scapula and its spine. Insertion: by a tendon to the inside of the great tuberosity of the humerus. Action: extends the humerus.

Infraspinatus. Origin: the whole extent of the infraspinatus fossa. Insertion: by a tendon to the external face of the great humeral tuberosity. Action: to abduct the humerus and rotate it outward.

TERES MINOR. Origin: posterior (axillary or caudal) border of scapula and by a small tendon from the external side of margin of glenoid cavity. Insertion: on the humerus near the top of the deltoid ridge. Action: to flex the shoulder joint.

TERES MAJOR. Origin: dorsal surface of scapula near the angle, and the posterior border of the subscapular muscle. Insertion: chiefly by its tendon to the internal tuberosity of the humerus. Action: to flex the shoulder joint and draw the arm back.

SUBSCAPULARIS. Origin: the whole under surface of scapula. Insertion: by thick tendon to the internal tuberosity of the humerus. Action: to extend the shoulder joint and push the arm forward.

THE MUSCLES OF THE ARM.

Plates VII., VIII., IX., X., XIII., XVI., XVII., XVIII., XXIII.

Biceps (*Biceps brachii*, *Coraco-radialis*, *Long Flexor of Arm*). Origin: by a thick tendon at base inside of the coracoid process. Insertion: by one tendon to the bicipital tuberosity of the radius and by a smaller tendon to the tuberosity of the ulna. Action: to flex the fore-arm.

Brachialis anticus (*Humeralis obliquus*, *Humeralis externalis*, or *Short Flexor of Arm*). Origin:

on the de
the tendon

CORAC
the humeru
shoulder jo

EPITR
a muscle of
Mivart give
dorsi, of wh
side of olec

Tricep
four well-m
treat the f
Others treat
for us to tre
its tendon i

Lon

Out

Inn

Post

Ancon
humerus.
and prevent

The m
Six
Se
Tw
Tw

Extens
of the Meta
outer side of
Action: it e

Extens
in the epic
the first. A
Extens
Ext. suffrag

on the deltoid ridge of the humerus. Insertion : by a small tendon which forks and unites with the tendons of the biceps. Action : to flex the fore-arm.

CORACO-BRACHIALIS. Origin : the beak of the coracoid. Insertion : by a flat muscular band to the humerus by the internal tuberosity. Action : to advance the arm, and rotate it inwards, and extend the shoulder joint.

EPITROCHLEARIS (*External Dorso-epitrochlear, Extensor antibrachii longus, Tensor fasciæ antibrachii*), a muscle of but slight importance though superficial. I fail to detect it in the living Dog or Cat, though Mivart gives it great prominence in the latter. Origin : of its principal head in the fascia of the latissimus dorsi, of which it seems to be a mere slip ; it is also attached to the spine of the scapula. Insertion : inner side of olecranon. Action : to draw the arm backwards and aid the triceps.

Triceps (*Anconeus longus, A. vastus, or Caput longus*). A very important and prominent muscle in four well-marked parts or heads—the long, the outer, the inner, and the posterior heads. Some authorities treat the four divisions of the triceps as one muscle, with four different origins and one insertion. Others treat them as four distinct muscles. As the divisions are quite well marked, it will be better for us to treat them separately. Nevertheless, in the living animal, the fossa between the long head and its tendon is much more pronounced than the depression between any two of the divisions of the triceps.

Long Head. Origin : nearly the whole axillary or caudal border of scapula. Insertion : the top of the olecranon. Action : to extend the fore-arm.

Outer Head (*Anconeus externus, A. brevis, or A. lateralis*). Origin : on the deltoid ridge or spine of the humerus. Insertion : the olecranon. Action : to extend the fore-arm.

Inner Head (*Anconeus internus, A. medialis*). Origin : along the inner side of humerus below the lesser tuberosity. Insertion : chiefly by a tendon, to the inner side of the olecranon. Action : to extend the fore-arm.

POSTERIOR OR DEEP HEAD (*Anconeus posticus*). Situated behind the inner head and uniting with it near the olecranon. Origin : the under edge of the head of the humerus. Insertion : the olecranon fossa. Action : to extend the fore-arm.

Anconeus (*A. parvus or quintus*). Origin : the back of the external condylar process of humerus. Insertion : capsule of the elbow joint. Action : to raise the articular capsule that it covers and prevent it being pinched between the two bony surfaces, and to aid the triceps.

THE MUSCLES OF THE FORE-ARM.

Plates VIII., IX., XIII., XVI., XVII., XVIII., XIX., XXIII.

The muscles that belong strictly to the fore-arm group themselves as follows :—

Six Extensors on the outer side and fore part of limb.

Seven Flexors on the inner side and hind part of limb.

Two Supinators.

Two Pronators.

Extensor carpi radialis (*Extensor magnus, Radialis lateralis, R. externus or Anterior Extensor of the Metacarpus*), an important muscle. Origin : chiefly from the supracondylar ridge on the outer side of the humerus. Insertion : by two tendons to the upper ends of second and third metacarpals. Action : it extends the metacarpus on the fore-arm.

Extensor digitorum communis (*Ext. pedis, Anterior Ext. of Phalanges*). Origin : chiefly on the epicondyle. Insertion : by a four-forked tendon one branch into each of the digits except the first. Action : to extend these fingers and to help to extend the hand.

Extensor digitorum brevis (*Ext. digitorum lateralis, Ext. dig. tertii, quarti, quinti proprius, Ext. suffraginis or Lateral Extensor of Phalanges*.) Origin : chiefly from the external epicondyle.

Insertion: by a three-forked tendon to the three outer digits. Action: to extend these three digits and to help to extend the hand.

EXTENSOR POLLICIS LONGUS ET INDICIS PROPRIUS, a very small and unimportant muscle. Origin: with the oblique extensor on the outer border in the middle of the ulna. Insertion: the thumb and index by a two-forked tendon. Action: to extend the thumb and index.

Extensor carpi ulnaris. This muscle is one of the most striking features of the side of the arm. Origin: from the external epicondyle by a short strong tendon. Insertion: after forking it is inserted by a short wide posterior tendon into the pisiform, and by its long round tendon into the external metacarpal. Action: to extend the carpus with slight outward rotation.

EXTENSOR OBLIQUUS (*Extensor ossis metacarpi pollicis*, *Abductor longus pollicis*, or *Oblique Extensor of Metacarpus*). Origin: outer edge of ulna and radius. Insertion: head of the internal metacarpal. Action: to extend the first toe.

Flexor digitorum sublimis, or **Perforatus** (*Sublimis*, *Superficial Flexor of the Fingers*, *Outer Flexor*). Origin: the inner epicondyle. Insertion: by a tendon passing through the carpal sheath and in four branches to the second phalanx of each of the four main digits. Action: to flex the toes and the whole foot on the fore-arm.

Flexor digitorum profundus, or **Perforans** (*Deep Flexor of the Fingers*). The three parts of this complicated muscle have been described separately as *deep flexor*, *radial palmar*, and *ulnar palmar*. The deep flexor or humeral portion takes origin on the inner epicondyle; it is in three separate bundles of fibres. The radial palmar rises on the inner edge of the radius. The ulnar palmar rises on the back edge of the ulna. Insertion: these three parts unite in a tendon which passes through the carpal sheath and divides into five branches—one for each digit. Action: to flex the toes and foot.

PALMARIS LONGUS, a very small and unimportant muscle on the back of the perforans, and inserted by a two-forked tendon into the perforatus tendons near the toes. Action: to bend the hand.

Flexor carpi radialis (*Palmaris magnus*, *Radialis internus*, *R. medialis*, or *Internal Flexor of Metacarpus*). Origin: on the inner epicondyle. Insertion: by a two-forked tendon to the second and third metacarpals. Action: to flex the carpus on the fore-arm.

Flexor carpi ulnaris (*Ulnaris internus or medialis*, *Supercarpus*). This, especially at its lower and tendinous end, is of prime importance in the form of the limb. Origin: in two parts—one from the inner epicondyle of the humerus, and the other from under side of the olecranon. Insertion: the two parts unite and are inserted into the pisiform and fifth metacarpal. Action: to flex the carpus and fore-foot or hand.

SUPINATOR LONGUS (*Brachio-radialis*). This muscle, so well developed in the Cat, is rudimentary or wanting in the Dog. Origin: with the extensor carpi radialis on the epicondyloid crest of the humerus. Insertion: on the inner face of the radius. Action: to turn the radius laterally outwards, *i.e.* to supinate the arm.

Supinator brevis. Origin: on the epicondyle of humerus and surrounding fascia, and on the outer side of the radius. Insertion: by its fleshy fibres to the inner edge of radius. Action: to turn the arm so that the paw turns inwards and upwards.

Pronator radii teres (*Round Pronator*). A marked feature of the inner surface. Origin: the inner epicondyle of the humerus. Insertion: the internal side about the middle of the radius. Action: to turn the paw downward and outwards by rotating the radius.

PRONATOR QUADRATUS (*Square Pronator*). A thick quadrilateral muscle with transverse fibres extending from the ulna to the radius nearly their whole length. Action: to counteract the supinators.

THE MUSCLES OF THE PAW.

Plate XIX.

In the paw of the Dog, are a number of small muscles, which however have but little effect on the visible form, excepting as a fleshy mass, under the flexor tendons of the fingers or fore-toes. They may be grouped together as the *Plantar Flexors*. According to Messrs. Ellenberger and Baum they are as follows:—

PALMARIS BREVIS.

LUMBRICALES.

INTEROSSEI.

ABDUCTOR POLLICIS BREVIS ET OPPONENS POLLICIS.

FLEXOR POLLICIS BREVIS.

ADDUCTOR POLLICIS.

ADDUCTOR MINIMI DIGITI.

FLEXOR BREVIS MINIMI DIGITI.

ABDUCTOR MINIMI DIGITI.

ADDUCTOR INDICIS.

CHAPTER XII.

THE MUSCLES OF THE DOG (*continued*).

THE MUSCLES OF THE HAUNCH.

Plates VIII., IX., X., XIII., XIV., XV., XX., XXII., XXIII.

PSOAS MAGNUS. It is within the abdominal cavity. Origin: on the under side of the last three or four lumbar vertebræ and on the edge of the ilium. Insertion: the internal or lesser trochanter of the femur. Action: to flex and rotate the thigh or flex and incline the lumbar region laterally when the thigh is fixed.

PSOAS PARVUS. Also within the abdominal cavity, and it is more properly a muscle of the trunk. Origin: the last three or four dorsal and the first one or two lumbar vertebræ. Insertion: the ilio-pectineal crest on the edge of the pelvic basin. Action: to flex the pelvis on the spine.

OBTURATOR INTERNUS. Origin: around the obturator foramen inside the pelvis. Insertion: by a tendon which passes out behind the sciatic or ischiatic ridge, and ends in the hollow behind the great trochanter. Action: to rotate the thigh outwards.

OBTURATOR EXTERNUS. Origin: on the under or outer side of the ischium and pubic bone opposite the preceding. Insertion: by a tendon into the hollow behind the great trochanter, near the preceding. Action: to rotate outwards and adduct the thigh.

Tensor vaginae femoris (*Tensor fasciæ latae*), in two parts, a *long* and a *short*. Origin: external angle of ilium. Insertion: into the fascia lata, vagina femoris, or sheath which envelops the side of the thigh and to some extent the underlying muscles individually. Action: to flex the thigh and make tense its sheath, the vagina femoris.

Gluteus maximus (*Superficial Gluteus*). Origin: arises by fascia from the membrane covering the sacrum, coccyx, and surrounding region. Insertion: into the great trochanter and into the fascia lata. Action: to abduct the thigh; or it acts as an extensor, when the sacrum is fixed, and rotates the knee outward.

Gluteus medius. Origin: entire crest of ilium and surrounding fascia. Insertion: by a large tendon to the outer surface of the great trochanter. Action: to extend, rotate, or abduct the thigh, when the pelvis is fixed, but when the femur is fixed it causes the pelvis to rock, as in rearing.

GLUTEUS MINIMUS (*Deep Gluteus*). Origin: neck of ilium and sciatic spine. Insertion: low on the great trochanter. Action: to abduct the thigh and rotate the femur inwards.

PYRIFORMIS (*Pyramidalis*). Origin: chiefly on the ventral surface of sacrum, passing out by the sciatic notch. Insertion: the great trochanter with the gluteus medius. Action: to rotate the hind limb outwards and assist the glutei generally.

QUAD
the femur.

GEME
of ischium
rotate the t

Bicep
of the thigh
on the two
between the
muscles, and
Action: it
lateralises th
A very
It arises in
femur.

Semite
passing over
flex the knee
Semim
ischiatric tub
epicondyle o
limb, to exte

Sartori
ilium. Inse
the tibia and

Quadri
triceps of th
separate mus
into the tub

The sm
stitutes the f
great extens

Rect

Vast

Vast

CAPSUL
Origin: from
Action: to c

QUADRATUS FEMORIS. Origin : inferior surface of the ischium. Insertion : the back upper end of the femur. Action : to extend and adduct the femur.

GEMELLUS. In two parts, *anterior or superior*, and *posterior or inferior*. Origin : spine and tuberosity of ischium. Insertion : by a tendon that ends in the hollow behind the great trochanter. Action : to rotate the thigh outwards or carry it forward.

THE MUSCLES OF THE THIGH.

Plates VIII., IX., X., XIII., XIV., XX., XXII., XXIII.

Biceps femoris. This is the muscle whose sharp ridge is the prominent feature of the outside of the thigh at its under half. The ridge not only varies in different individuals, but often is quite different on the two sides of the same animal. Origin : on the ischiatic tuberosity and the ligaments which stretch between the ischium and the sacrum. Insertion : by a great aponeurosis which spreads over the tibial muscles, and is inserted into the knee, the tibial crest, the fascia lata, and by a tendon into the calcaneum. Action : it flexes the leg, renders tense the tibial fascia. When the leg is fixed it extends, rotates, or lateralises the pelvis on the femur.

A very thin, deep-lying, unimportant ribbon of the biceps has been described as the *Tenuissimus*. It arises in the sacro-sciatic ligament, and is inserted into the biceps down near the bottom of the femur.

Semitendinosus, in two parts. Origin : on the ischiatic tuberosity. Insertion : by a tendon passing over the internal surface of the tibia into its crest, and into the surrounding fascia. Action : to flex the knee and make tense its tibial aponeurosis, also it draws back the thigh and pushes the body forward.

Semimembranosus, in two very distinct parts, appearing like two separate muscles. Origin : ischiatic tuberosity and inferior face of ischium. Insertion : by two heads, one into the fascia about the inner epicondyle of the femur, and the other into the internal tuberosity of the tibia. Action : to adduct the limb, to extend the thigh, and to flex the knee.

Sartorius, in two very distinct parts. Origin : the external angle and ventral border of the ilium. Insertion : of one part the ligament of the patella, and of the other the internal head and neck of the tibia and surrounding fascia. Action : to adduct the leg and carry the thigh forward.

Quadriceps extensor cruris. This is the great extensor of the leg. It corresponds to the triceps of the arm. It arises by three heads in three separate parts as below. These have been treated as separate muscles, but all unite and have a common insertion into the tendon of the patella, and through it into the tuberosity of the tibia, and a common purpose of extending the knee joint.

The small deep-lying bundle of fibres that represents the *Crural* muscle of human anatomy, and constitutes the fourth head of the quadriceps, is in the Dog more or less fused with the adjoining parts of that great extensor.

Rectus femoris. Origin : on part of the ventral margin of ilium and margin of acetabulum.

This is the middle and superficial part of the quadriceps.

Vastus externus. This is the muscle which chiefly gives form to the fore outer side of the thigh, though it is overlaid by the fascia lata. Origin : on the upper outer surface of the femur and on the great trochanter.

Vastus internus. Origin : on the inner side of front of the femur under the great trochanter.

This is the largest part of the quadriceps.

CAPSULARIS. This small muscle is considered by some writers as a deep portion of the quadriceps. Origin : from the front of the femur near the head. Insertion : into the capsule of the joint in front. Action : to draw the thigh forward.

Gracilis. Origin : by tendinous fascia from the symphysis of the pubes. Insertion : into the inner side of the tibia. Action : to adduct the thigh.

Pectineus. Origin : anterior part of pubic bone and brim of pelvis. Insertion : the back of the femur near its lower end. Action : to flex, adduct, and rotate inwards the femur.

Adductor magnus. Origin : on the pubic rami, from the symphysis to the tuberosity of the ischium. Insertion : the linea aspera at the back of the femur. Action : to adduct and rotate outwards the thigh and push the body forward.

THE MUSCLES OF THE LOWER LEG.

Plates VIII., IX., XIII., XX., XXI., XXIII.

Tibialis anticus. Origin : the external head of the tibia and surrounding fascia. Insertion : by a strong tendon into the rudimentary first metatarsal (apparently the head of the second). Action : to bend the foot forward and upwards on the leg.

Extensor pedis. Origin : by a strong tendon outside the outer epicondyle of the femur ; it becomes a tendon passing through a loop on the ankle. Insertion : it forks in four tendons, one of which goes to each toe. Action : to extend the toes and draw the foot forward.

EXTENSOR POLLICIS LONGUS (*Long Extensor of the Great Toe*). A minute muscle intimately connected with the extensor pedis, and of no consequence to the artist.

Peroneus longus (*P. lateralis*). Origin : on the external tuberosity of the tibia. Insertion : its tendon passes down in front of the external malleolus, in front of fibula, and behind the foot, when it is apparently lost in the deep fascia, but it is really inserted near the head of first or rudimentary metatarsal. Action : to turn outwards the lower end of the limb.

PERONEUS BREVIS, an unimportant muscle. Origin : outer lower part of fibula and tibia. Insertion : into upper or proximal end of fifth metatarsal by a tendon which passes behind the external malleolus and under the tendon of the peroneus longus. Action : to flex the foot.

Gastrocnemius. Origin : chiefly by two principal heads, from the back of the femur above the two tuberosities on the sesamoid bones which develop in the tendons. Insertion : the summit of the calcaneum. Action : to extend the foot on the tibia.

Perforatus, or Flexor digitorum sublimis (*Superficial Flexor of Phalanges*). Origin : with the outer head of the gastrocnemius in the hollow behind the femur at the lower end. Insertion : by a tendon which passes over the calcaneum and forking in four tendons inserts one into each of the main digits. Action : to flex the toes, draw back the foot, and bend the knee.

Perforans (*Deep Flexor of the Phalanges, Flexor pedis*). Origin : In two distinct parts, a *large* or *outer* and a *small inner* or *auxiliary*, on the hinder surface of tibia, of fibula, and adjoining fascia forming two tendons, which unite after passing behind the internal malleolus, and in the plantar region again divide into four tendons which are inserted into the distal phalanges of the digits after perforating the tendons of the perforatus ; it also gives off another thin tendon which forks and is inserted into the plantar pad. Action : to flex the toes and draw the foot backwards.

TIBIALIS POSTICUS, or FLEXOR ACCESSORIUS (*Oblique Flexor of Phalanges*), a very minute and unimportant muscle. Origin : on the hinder surface of head of fibula. Insertion : its tendon passes with the inner head of the deep flexor through a special groove in the internal malleolus, and is inserted into the fascia of the tarsus. Action : to flex or rotate the foot.

Popliteus. Origin : by a thick tendon on the external tuberosity of the femur. Insertion : posterior surface of the upper portion of the tibia. Action : to rotate the tibia sideways and outwards.

THE HIND-FOOT.

Plates XX., XXI.

Extensor brevis digitorum. Origin : in front of tarsus on calcaneum and cuboid. Insertion : by a tendon into each of the digits except the fifth. Action : to extend the toes.

PLANTAR FLEXORS. Under this name I enter the mass of minute muscles in the sole of the foot. Several of them are like those already noted in the sole of the fore-paw or hand. The following is the list :—

LUMBRICALES.**INTEROSSEI.****SQUARE FLESHY FLEXOR—RELATED TO THE PERFORANS.****ADDUCTOR QUINTI DIGITI.****ADDUCTOR INDICIS.**

CHAPTER XIII.

THE MUSCLES OF THE DOG (*continued*).

THE MUSCLES OF THE TAIL.

Plates VIII., IX., X., XIII., XIV., XV., XXII.

Erector (*Extensor coccygis*). This is in two parts, a *long* part, which is really a caudal continuation of the longissimus dorsi, and a *short*, next the spine and which is really a continuation of the spinalis. Origin: the processes of the lumbar and sacral vertebræ. Insertion: the caudal vertebræ. Action: to raise the tail.

Curvator, a small muscle outside of the preceding. It draws the tail sideways and upwards.

Coccygeus. Origin: inner side of ilium. Insertion: caudal vertebræ. Action: to depress the tail and draw it sideways.

Depressor (*Flexor coccygis*), in two distinct parts, an *outer* or *long*, and an *inner* or *short*. Origin: on each side of sacrum and coccyx. Insertion: on caudal vertebræ. Action: to depress the tail.

The INTERTRANSVERSALES are minute muscles between the processes of the caudal vertebræ. In some animals these are very well developed, but in the Dog they are too small to need description.

THE MUSCLES OF THE ANUS.

Plates XIV., XXII.

LEVATOR ANI, attached to the inner face of the pelvic bones, to the caudal vertebræ and to the anus. Action: to constrict the anus.

SPHINCTER ANI, in three parts, *outer*, *inner*, and *mediator*. Action: to close the anus.

TRANSVERSUS PERINEI, an unimportant muscle, attached to the bulbo-cavernosus.

BULBO-CAVERNOSUS, a somewhat prominent muscle in the male; it envelops the bulb of the urethra, and is a constrictor of the same.

ISCHIO-CAVERNOSUS, a small muscle connected with the foregoing.

THE G
30 to 34 inc
weight of 20
St. Bern
with a weigh
Greyho
The din
There a
animal than
ordinary Wo
clearly as m
about 5 head
size of the h
A Tiger but
giant. A D
But if we let
original size
at the should
(See Plate X
The fift
a reversion to
An examin
instance of th
In the
This is an i
In all ca
The abo
pression of b
Dane, Newfo
re greatly re
It is wo
re however

CHAPTER XIV.

THE SIZE AND PROPORTIONS OF THE DOG.

Plate XXIV.

THE Great Dane, the Irish Wolfhound, and the Mastiff are the largest of the Dogs. They range from 30 to 34 inches at the shoulder, and specimens as high as 35 inches are on record; such animals attain a weight of 200 lbs.

St. Bernards are nearly as large; indeed the celebrated Sir Bedivere was $33\frac{1}{2}$ inches at the shoulder, with a weight of 212 lbs.

Greyhounds are from 24 to 27 inches at the shoulder, and weigh 60 or 70 lbs.

The dimensions of a large Dog of unknown breed will be found in the table of bone measurements.

There are many reasons for believing that the Dog is a thoroughly domesticated Yellow Wolf, a smaller animal than the true Wolf (*Canis lupus*). For although we see enormous Dogs far surpassing in size the ordinary Wolf, it is not hard to find in these giants visible and constitutional defects which stamp them clearly as mere giantisms, cases of over-development. The following illustrates this point:—A child is about 5 heads in height, a man about $7\frac{1}{2}$, and a giant 10 or 11. Thus it may be readily discerned that the size of the head in man is the least variable of the dimensions. The same rule applies in the other species. A Tiger but 2 heads in height at the shoulder would be a cub or a dwarf, and a Tiger 3 heads high a giant. A Dog of any large thoroughbred race is 3 heads high; his wild kinsman, the Wolf, is but $2\frac{1}{2}$. But if we let any kind or number of breeds of Dog revert to their ancestral type, so as to re-establish their original size and form, we shall infallibly get a yellowish, wolfish, prick-eared animal about 23 inches high at the shoulder—*i.e.*, smaller than a Wolf but of like proportions, its body going in a square of $2\frac{1}{2}$ heads. (See Plate XXIV.)

The fifth toe or 'dew-claw,' which frequently appears on the hind feet of large Dogs, is a blemish, a reversion to some five-toed ancestral form, another proof that these Dogs are physically over-developed. An examination of some scores of Gray Wolves and over a hundred Coyotés has failed to discover a single instance of this malformation.

In the Dog and all carnivores, the lower canines are in front of the upper when the jaws are closed. This is an important element of expression.

In all carnivores, perhaps in all true quadrupeds, the fore feet are larger than the hind feet.

The above remarks on proportion apply as well to the Greyhound; for although it gives the impression of being very long and thin, it is in fact of much the same proportions as a Foxhound, Great Dane, Newfoundland, &c. The difference is chiefly in the loose integuments and fur which in this animal are greatly reduced.

It is worthy of notice that all swift-footed animals go in a square, or else are higher than long. There are however exceptions to this rule: for example, the Elephant is $2\frac{1}{2}$ heads in height by 2 in length, and is

a slow, clumsy animal beside the Rhinoceros, which is 2 heads in height by 3 heads in length, and is remarkable for its activity and speed.

In nearly every case the proportional measurements given are bone measurements. The head however, not the skull, is the standard; it is measured from the point of the occipital tuberosity to the point of the nose. When it is the skeleton that is being measured, add one-tenth to the length of the skull to give the length of the head. Sometimes it is not possible to see the point of the occiput in the living animal on account of the fur or ears obscuring the region; it will be found on a line with the back edge of the ear when the latter is directed forward, or with the back edge of the opening of the ear when it is in a normal position.

The square that includes the body is drawn just before the head of the humerus to the height of the shoulder, thence to the top of the hip-bone or ilium, and back of the ischiatic tuberosity to the base line.

Although on Plate XXIV. the proportions of the Dog are clearly set forth, they will be given categorically, so that the more important ones may be emphasised:—

1. The body goes in a square whose side	... .. equals 3 heads
2. At half the height of the sides of the square are the knee and elbow joints	
E, F.	...
3. Through the deepest part of the chest	... .. 1½ head
4. The neck above, from the occiput A to the end of the neck-thatch or mane G	... .. 1 "
5. The neck below	... .. 1 "
6. The length of the neck vertebrae, i.e., the interior line of the neck, C D	... .. 1 "
7. The depth of the neck at base	... .. 1 "
8. The length of the humerus	... .. 1 "
9. " " " radius	... .. 1 "
10. " " " femur	... .. 1 "
11. " " " tibia	... .. 1 "
12. The width of the body through the biceps of the thigh, i.e., the widest point N	... .. 1 "
13. The length of the scapula	... .. ¾ "
14. The width of the chest at its widest point O	... .. ¾ "
15. " " " shoulder through the acromions	... .. ¾ "
16. The depth of the loins	... .. ¾ "
17. The width of the thigh at H I	... .. ¾ "
18. The length of the foot L M	... .. ¾ "
19. The depth of the head from throat to front	... .. ½ "
20. " " " neck at throat	... .. ½ "
21. The length of the fore-foot from P to the ground	... .. ½ "

ACCORD
Europe, Nor
Europe, Wh
synonyms or
The W
than in anat
An ord
inches in le
The females
The fol
immediately

Len
Tai
Hei
Gir
Gir
Gir
We

This sp
as 150 lbs.
Sir Joh
at Fort Fran

Len
Tai
Hei

n length, and is

the head however,
the point of the
skull to give the
living animal on
back edge of the
ear when it is in a

the height of the
to the base line.
they will be given

3 heads

1 1/2 head

1 " "
1 " "
1 " "
1 " "
1 " "
1 " "
1 " "
1 " "
1 " "
1 " "
1 " "
1 " "
1 " "
1 " "
1 " "
1 " "
1 " "
1 " "
1 " "

CHAPTER XV.

THE ANATOMY, SIZE, AND PROPORTIONS OF THE WOLF.

(*Canis lupus*).

Plates I., XXIV.

ACCORDING to the best authorities there is no constant or reliable difference between the Wolves of Europe, Northern Asia, and North America. The various terms—Russian Wolf, Common Wolf of Europe, White Wolf, Timber Wolf, Buffalo Wolf, Gray Wolf, etc., are then to be understood either as synonyms or as names of local varieties of *Canis lupus*.

The Wolf is simply a large wild Dog, and differs from the domesticated species more in appearance than in anatomical details.

An ordinary male wolf is from 27 to 28 inches in height at the shoulder, and about 3 feet 9 inches in length of the head and body. When in good condition he weighs from 90 to 100 lbs. The females are smaller.

The following are the dimensions of a fair-sized American Gray Wolf, a male; they were taken immediately after death:—

											Feet.	Inches.
Length from top of nose to end of bone in tail	...	...	...	...	...	...	...	...	...	...	5	2
Tail bones	...	...	...	...	...	...	...	...	...	...	1	4
Height at shoulder	...	...	...	...	...	...	...	...	...	...	2	3
Girth of fore-arm	...	...	...	...	...	...	...	...	...	...	—	8 1/2
Girth of neck...	...	...	...	...	...	...	...	...	...	...	1	6
Girth of chest	...	...	...	...	...	...	...	...	...	...	2	4 1/2
Weight, 102 lbs.												

This species, however, seems to be subject to great variation, and specimens weighing as much as 150 lbs. are on record.

Sir John Richardson gives the following dimensions of a Gray Wolf that was starved to death at Fort Franklin, April 1821:

											Feet.	Inches.
Length of head and body	...	...	...	...	...	...	...	...	...	...	4	2
Tail	...	...	...	...	...	...	...	...	...	...	1	7
Height at shoulder	...	...	...	...	...	...	...	...	...	...	2	8

Franklin mentions a large White Wolf that measured as follows :

											Feet.	Inches.
Length of head and body	...	...	...	...	...	...	...	...	...	...	4	4
Tail	...	...	...	...	...	...	...	...	...	...	1	7
Height at shoulder	...	...	...	...	...	...	...	...	...	...	2	10
Girth behind fore-legs	...	...	...	...	...	...	...	...	...	...	2	6

Audubon and Bachman give the following measurements of an American Gray Wolf in winter pelage.

											Feet.	Inches.
Length from point of nose to root of tail	...	...	...	...	...	...	...	...	...	...	4	—
" of tail (vertebræ)	...	...	...	...	...	...	...	...	...	...	1	1
" to end of hair	...	...	...	...	...	...	...	...	...	...	1	5
Height of ear	...	...	...	...	...	...	...	...	...	...	—	4
Breadth of ear	...	...	...	...	...	...	...	...	...	...	—	3
From point of nose to end of skull	...	...	...	...	...	...	...	...	...	...	—	11½
From eye to point of nose	...	...	...	...	...	...	...	...	...	...	—	5
From shoulders to longest nail	...	...	...	...	...	...	...	...	...	...	2	4
Longest upper canine tooth	...	...	...	...	...	...	...	...	...	...	—	1½
Length of the hair on the back	.....	...	...	...	...	...	...	...	...	...	—	3 to 4

The proportions of the bone lengths of the Wolf are the same as those of the Greyhound, if we add one quarter to the head and neck after constructing on the plan of the Dog. Or in other words, if we take the humerus as the unit or standard, the head = $1\frac{1}{4}$, the neck = $1\frac{1}{4}$, and the other proportions are as in the Greyhound (see Plate XXIV.). The Wolf, however, has the forequarters more robustly made, to correspond with the heavier head and neck ; his loins are heavier, and his coat of fur is well developed.

The Coyoté or Prairie Wolf (*Canis latrans*) might well be styled the American Jackal. It is a small Wolf standing about 20 inches high at the shoulder with a weight of about 25 lbs.

THE
differences
pupil of
the Fox.
The

Audubon

Mivar
Foxes, says
The
adusta) in
the other
has any p
the tail.

Inches.
4
7
10
6

Wolf in winter

Inches.

1
5
4
3
11½
5
4
1½
3 to 4

reyhound, if we
in other words,
the other pro-
portions more
and his coat of

Jackal. It is a
lbs.

CHAPTER XVI.

THE FOX.

THE FOX resembles the Dog and Wolf in its general anatomy and proportions; its chief visible differences being the smaller, lighter form, the sharper nose, larger ears, bushier tail, and the linear pupil of the eye. The arrangements of hair, described in Chapter I. are largely lost sight of in the Fox.

The following measurements of the European Red Fox are given by Bell (*Brit. Quad.*):—

	Feet.	Inches.
Length of the head and body	2	3½
" " " head	—	6
" " " ears	—	3½
" " " tail	1	4
Medium height at the shoulders	1	2½

Audubon and Bachman give the following measurements of the American Red Fox:—

	Feet.	Inches.
From point of nose to root of tail	2	6
Tail (vertebræ)	1	1
Tail to end of hair	1	5
Height at shoulder	1	1
Height of ear posteriorly	—	2½

Mivart (*Monog. Canidæ*), after weighing the claims to separation of the American and European Red Foxes, says, 'We cannot hesitate to unite them under one title, *Canis vulpes*.'

The Red Fox of Europe, the Common Fox of America, and the Jackal of Central Africa (*Canis adusta*) invariably have the tail terminated in a white tip. The Gray Wolf and the Prairie Wolf, on the other hand, have the tail tip black. And the Dog, notwithstanding its kinship to the Wolf, if it has any pure white on the body, always has a white tip, or at least a few white hairs, in the end of the tail.

LIBRARY
NATIONAL MUSEUM

CHAPTER XVII.

THE ANATOMY, SIZE AND PROPORTIONS OF THE CAT.

Plate XXV.

THE anatomy of the Cat bears a general resemblance to that of the Dog. The differences are chiefly matters of degree, as will be seen on comparing Plates VIII. and XXV. There are, however, some positive differences which should be kept in mind,—thus, all Cats have a clavicle, or collar-bone, in each shoulder, it is small but morphologically important; on the spine of the scapula is a process, called the metacromion, that is like a second acromion; and the claws with their sheaths, as well as the muscles which govern them, are highly developed so as to be sharp, recurved, and eminently retractile weapons. The whole skeleton is more elastic and better jointed, although the rest of the bones are similar to those of the Dog.

The Cat has also more and better developed muscles. Thus, in the fore-leg the supinator longus is far from being rudimentary; in the hind-leg it has the soleus; and according to Mivart, it has on the breast a second sternalis.

The shoulder has so much play that the scapula may touch the jaw, or slide back as far as the eighth or tenth rib; while the muscles regulating these movements are greatly developed, endowing the Cat with remarkable power for climbing and for striking blows.

But these differences, it will be seen, are secondary matters, and would not impair the truth of the broad statement, that in their Art Anatomy the Dog and the Cat are identical.

An average female of the ordinary House Cat measured as follows:—

	Feet.	Inches.
Length of head	—	3 $\frac{7}{8}$
Length of neck from occiput to point of scapula	—	3 $\frac{3}{8}$
Length of body from point of manubrium to point of ischium	—	11 $\frac{1}{2}$
Total length from point of nose to point of ischium	1	5 $\frac{1}{2}$
Height at shoulder	—	8 $\frac{1}{2}$
Length of tail	—	8 $\frac{1}{2}$

Males are, of course, larger and heavier, but the relative bone lengths are the same.

The proportions are, as will be seen in the above:—

Total length of head and body	equals	5 heads
Height at shoulder equals half the total length	"	2 $\frac{1}{2}$ "
Length of tail equals half the total length	"	2 $\frac{1}{2}$ "
Length of body from manubrium to ischium	"	3 $\frac{1}{2}$ "

The proportions of the limb bones will be found to agree exactly with those of the Lion indicated on Plate XXVII., although the relative length and height of the body are not the same. The Cat and its kind are thus too low and long to fill a square, as do the Dog, Horse, Deer, &c.

It is worthy of note that, whatever be the figure that includes the animal's body, the same figure of but half the dimensions usually appears in the space that is comprised by the belly, legs, and ground.

In the Cat family, add $\frac{1}{16}$ th to the length of the skull to find the length of the head in life.

IT is
four varieties
covered with
Lion, with
the Cat. T
ments. On
with the pla
centre of liv
is another c
hair have be
Lions v
shoulder. I
mane about
of such sur
conform to
remember al
teasing of th
short.

Accord
to insertion
same author
after the ent
Mr. W
at the shoul
Accord
The fol
in 1895:—

Lio
" "
Lio
"

CHAPTER XVIII.

THE ANATOMY, SIZE AND PROPORTIONS OF THE LION.

Plates IV., XXVI.

It is now generally conceded that there is only one species of Lion, though there are, perhaps, four varieties:—the Indian Lion, with very little mane; the Babylonian Lion, with the shoulder covered with mane; the North African Lion, with the mane usually black; and the South African Lion, with the mane usually yellow. The Lion in its muscular and bony anatomy closely resembles the Cat. The chief differences are the slightly dissimilar proportions; the mane and other hairy developments. On Plate IV. is given a plan of the Lion's mane; it will be found to agree in general disposition with the plan of hair arrangement indicated in Chapter I. and Plate I. But on the shoulder is a curious centre of divergence that is seen only in the large Cats; it is of course well marked in the Lioness. There is another centre of this sort in the middle of the pelvic region of the spine. These various radiations of hair have been used to great advantage by Barye in his different Lion groups.

Lions vary greatly in the extent, length, and arrangement of the mane. In some it covers the entire shoulder. But the naked-shouldered Lion is the sculptor's favourite; it has all the picturesque effect of the mane about its great head and throat, and yet on the shoulder exhibits the powerful muscles that are capable of such surprising feats. The hair-tufts that grow on the elbow, on the belly, and on the end of the tail, conform to the general rules in Chapter I., but are subject to extreme individual variation. It is well to remember also that the wild Lion never has a mane as long as that of the Lion in captivity, the combing and teasing of the brush and grass through which the animal crawls having the effect of keeping the mane very short.

According to Mr. R. A. Sterndale (*Mammals of India*), an Asiatic Lion is from 6 to 6½ feet from nose to insertion of tail; the tail itself is from 2½ to 3 feet long; the height at the shoulder is 3½ feet. The same author mentions that the weight of a Lion which was 8 feet 9½ inches in total length, was 490 lbs. after the entrails were removed.

Mr. W. T. Blanford (*Fauna of India*) records a Lion that was 8 feet 9½ inches long, and 3 feet 6 inches at the shoulder.

According to Vogt, a Lion reaches a weight of 200 kilos, or about 441 lbs.

The following measurements from living specimens in the Jardin des Plantes were taken by the writer in 1895:—

The average length of three Lions, measured in skeleton, was 5 feet $5\frac{1}{2}$ inches from the nose to the ischium. The average height at shoulder of nine Lions was $33\frac{1}{2}$ inches. A large skeleton, known as 'Cuvier's Lion,' measured by De Blainville, gives an approximate height at the shoulder when alive of $39\frac{1}{2}$ inches.

In estimating the height of the animal from the skeleton, take five-sixths of the sum of length of scapula, length of humerus, length of radius, and distance from wrist-joint to the ground.

In its proportions the Lion differs from the true Cats, and approximates rather to the Dog form, as will be seen on comparing the Plates XXIV. and XXVII. In brief:—

A Dog goes in a square of 3 heads.

A Lion goes in a rectangle of $2\frac{1}{2}$ heads in height by 3 heads in length.

A Cat goes in a rectangle of $2\frac{1}{2}$ heads in height by $3\frac{1}{2}$ heads in length.

The Lioness presents no striking proportional differences. In the table (Chapter L.) are given measurements of a Lion and of a Lioness.

ALTHOUGH
larger, strong
Mr. Ste
the two, as
two.'

Mr. Bl
think, the m
Colonel
that he agre
in the Cent
not more th
ably smaller.
I have certai

Accordin
Tiger, and a
geric, the 'T
Accordin
feet.'

Sterndal

Measure

Len
"

He give
measurement

Len
Tail
Heel

the nose to the
skeleton, known as
er when alive of

um of length of

Dog form, as will

er L.) are given

CHAPTER XIX.

THE ANATOMY, SIZE AND PROPORTIONS OF THE TIGER.

ALTHOUGH the Lion is popularly called the king of beasts, most sportsmen agree that the Tiger is a larger, stronger, and more formidable animal.

Mr. Sterndale says in this connection: 'I should say that the Tiger was the more formidable of the two, as he is, I believe, superior in size. . . . I usually found the Tiger the larger of the two.'

Mr. Blanford says: 'Of the two, the Tiger, though standing lower, is heavier in the body and, I think, the more powerful animal.'

Colonel G. A. Sweny, a sportsman of some African and many years' Indian experience, writes me that he agrees with Mr. Blanford in the foregoing, and adds: 'The average full-grown male Tiger, in the Central Provinces of India, will weigh, when in good condition, about 400 lbs., but the female not more than 330 lbs. Average height at shoulder of male about 3 feet 4 inches; females considerably smaller. Assuming that my estimate of 400 lbs. is a reasonable average for the full-grown male, I have certainly seen a dead Tiger which weighed over 500 lbs., but only one.'

According to Colonel Percy (Badminton Library), 'The Lion is a less active animal than the Tiger, and apparently not so powerful; in every case of a fight between the two occurring in a menagerie, the Tiger has invariably killed his opponent.'

According to Jerdon: 'An average Tiger is 9 to 9½ feet in total length, or occasionally 10 feet.'

Sterndale gives the following:—

Measurements of two very large Tigers.

Length.	Girth of Chest.	Girth of Head.	Tail.	Girth of Fore-arm.	Height.
11 ft. 0 in.	4 ft. 6 in.	2 ft. 10 in.	3 ft. 4 in.	2 ft. 2 in.	3 ft. 7 in.
10 " 2 "	6 " 1 "	3 " 5 "	3 " 1 "	2 " 10 "	3 " 9 "

Measurements of the largest Tigress among seventy or eighty that came under his notice:—

	Feet.	Inches.
Length of Head and body	5	2
" " " " tail	3	2
Total	8	4

He gives a medium-sized Tiger at 9 feet 8½ inches, of which the tail was 3 feet; and adds these measurements of a male:—

	Feet.	Inches.
Length	9	5
Tail	2	10
Heel to shoulder	3	2

et. Inches.
3 11
2 —
5 3
2 7
3 —
3 3

stone (350 lbs.),
a large Tigress

en by the writer

et. Inches.
2 11 7/8
2 10 1/2
2 6 1/4
2 9 1/2
2 7 1/2
2 5 1/2

average of nine
that the Tiger is

ent in the Lion on

CHAPTER XX.

THE JAGUAR.

(*Felis onça*.)

THE Jaguar of South America is in effect a large Leopard. It is extremely variable in size; the specimen now living in the Jardin des Plantes is but 24 inches high at the shoulder; and yet Azara speaks of one that was 2 feet 9 inches high, its measurements being :—

	Feet.	Inches.
Length ...	6	9
Tail ...	2	2
Circumference of root of the tail ...	—	8
" " neck ...	2	1 1/2
" " fore-leg at the middle ...	1	2 1/2
" " ankle ...	—	8 1/2
" " head close to the ears ...	2	2 1/2
" " chest ...	3	11 1/2
" " hind part of body ...	2	11
Height at shoulder ...	2	9
Length of head as far as occiput ...	1	0 1/2
Height of ear ...	—	2 1/2
Width " " ...	—	2 1/2

There is, in the Museum of the Jardin des Plantes, the skeleton of a male which is even larger, it fairly rivals the Lion in size.

Its measurements are :—

	Feet.	Inches.
Length of skull ...	1	1 1/2
" " head in life, about ...	1	2 1/2
" " cervical vertebræ ...	—	10
" " dorsal vertebræ to point of ilium ...	2	10
From front of ilium to back of sacrum ...	—	6
" nose to sacrum ...	5	4
Height at shoulder ...	2	9 1/2
From manubrium to ischium ...	3	8 1/2

These, however, are exceptionally large individuals. Audubon gives an average specimen thus :—

	Feet.	Inches.
Nose to root of tail ...	4	1
Length of tail ...	2	1
Height of ear ...	—	2 1/2
Shoulder to end of claw ...	2	—
Length of largest claw ...	—	2
Around the wrist ...	—	7 1/2
Around the chest ...	3	—
Around the head ...	1	9 1/2
Breadth between eyes ...	—	3

The proportions of the Jaguar are like those of the Cat.

CHAPTER XXII.

THE COUGAR, PUMA, PANTHER, OR MOUNTAIN LION.

(Felis concolor.)

THIS is simply a large Cat of extraordinary agility and suppleness. In all its proportions and anatomy, it agrees with the Cat.

When young it is variegated, like most of the Felidæ, with black spots on the body, and rings on the tail. But these markings disappear as it matures, in order, it is supposed, to make it more like the Deer upon which it preys.

Audubon and Bachman give the following measurements :—

Male shot by J. W. Audubon, at Castroville, Texas, January 28th, 1846.

	Feet.	Inches.
From point of nose to root of tail	5	1
Tail	3	1
Height of ear posteriorly	—	3
Length of canine teeth from gums	—	1½

Female, killed January 26th, 1846.

	Feet.	Inches.
Length of head and body	4	11
" " tail	2	8
Height of ear	—	3
Length of canine teeth	—	1½
Weight 149 lbs.		

Dr. C. H. Merriam says :—

'In the Adirondacks it is an uncommonly large Panther that measures 8 feet from the end of its nose to the tip of its tail, and an unusually heavy one that weighs 150 lbs. * * * * Shot a male on Seventh Lake Mountain, that weighed about 200 lbs. This is the heaviest Panther concerning which I have been able to procure trustworthy information. * * * * An adult Panther stands about 2½ feet high at the shoulders.'

Mr. Rowley gives me the following measurements :—Panther, male, from Central Park Menagerie, New York : total length, 82 inches ; tail, 29 inches ; hind-foot, from point of calcaneum to point of longest toe, 11 inches.

Also another male from Barnum and Bailey's circus : total length, 84 inches ; tail, 30 inches ; hind-foot, 11 inches.

CHAPTER XXIII.

THE CHEETAH, CHITA, OR HUNTING LEOPARD.

(Cynailurus jubatus.)

THIS remarkable animal, although classed with the Cats, has somewhat of the Dog in its form, anatomy, habits, and proportions. It is long-legged, going in a square of three heads; its paws are but little prehensile, its claws are blunt and non-retractile, and it cannot climb. It is the species which properly bears the name 'Leopard,' as it was supposed by the ancients to be a hybrid between a Lion and a Pard or Panther; but the present allotment of names is according to modern usage.

Mr. Blanford says, 'It is probable that for a short distance the Hunting Leopard is the swiftest of all mammals.'

According to Jerdon :—

							Feet.	Inches.		Feet.	Inches.
Length of head and body about	...	...	...	...	...	...	—	—	...	4	6
Tail	...	...	...	...	...	...	—	—	...	2	6
Height	...	...	...	...	...	...	2	6	to	2	9
Basilar length of a skull...	...	...	...	...	...	...	...	...	...	—	5'35
Width across zygomatic arches	...	...	...	...	...	...	...	...	...	—	4'55

IN the
plantigrade
surface, from
five fully de
the rest. T
the shaggy c
other impor

As in t
hump—and
the Dogs in

The G
head long, t

¹ The arch
long to form a

CHAPTER XXIV.

THE BEAR FAMILY.

IN the Anatomy of the Bears the most important external difference from the Dogs and Cats is the plantigrade hind-foot, which is like the foot of man in being relatively short and so formed that the whole surface, from the heel or calcaneum to the toes, is set on the ground. The Bears also have on each foot five fully developed toes, with long non-retractile claws; the first toe on the fore-foot is on a level with the rest. The pointed muzzle, the small, close-set eyes, the rounded ears, the in-toeing of the fore-paws, the shaggy coat, the high arching of the back, the diminutive tail, and the lowness of its position are the other important peculiarities.

As in the Cats the edge of the scapula rises above the line of the dorsal spines, causing the shoulder hump—and the limbs are so articulated as to give them remarkable flexibility and play. But they resemble the Dogs in having no trace of a clavicle.

The Grizzly, Brown, and Black Bears go in a square of two heads.¹ The neck is three-quarters of a head long, the width at the shoulders one head, and at the trochanters three-quarters of a head.

¹ The arch of the back, however, rises considerably above the line; but for the shortening of the body by this arch, it would be too long to form a square, as is seen in the table of measurements.

og in its form,
its paws are but
he species which
between a Lion
ge.
s the swiftest of

Feet. Inches.
4 6
2 6
2 9
— 5'35
— 4'35

CHAPTER XXV.

THE GRIZZLY BEAR.

A GRIZZLY BEAR killed by Lewis and Clark near the Porcupine River, measured as follows :—

	Feet.	Inches.
Length from the nose to the extremity of the hind-foot	8	7½
Circumference near the fore-legs	5	10½
" of the neck	3	11
" " middle of the fore-leg	1	11
Length of the talons	—	4½

To this Ord adds, 'His weight on conjecture was between 500 and 600 lbs. But this was not the largest Bear killed by the party. They give an account of one which measured 9 feet from the nose to the extremity of the tail; and the talons of another were 6½ inches in length.'

Audubon and Bachman give the following :—Male, killed by J. J. Audubon and party on the Missouri River, in 1843, not full grown.

	Feet.	Inches.
From point of nose to root of tail	5	6
Tail (vertebræ)	—	3
" (including hair)	—	4
From point of nose to ear	1	4
Width of ear	—	3½
Length of eye	—	1
Height at shoulder	3	5
" " rump... ..	4	7
Length of palm of fore-foot	—	8
Breadth " " " "	—	6
Length of sole of hind-foot	—	9½
Breadth " " " "	—	5½
Girth around the body behind the shoulders	4	1
Width between the ears on the skull	—	7½

The following are the principal measurements of the Grizzly Bear skeleton, of which the full details are given in the table, Chapter L.

	Feet.	Inches.
Length of head in life	1	5½
" " neck	—	11½
Manubrium to ischium	3	10
Height at shoulder in life	3	2
Width between acromions	1	6
" " trochanters	1	1

THIS an
them as iden
The fol
are given in
It is a s

Len
Ma
Hei
Wid

as follows :—

Feet.	Inches.
8	7½
5	10½
3	11
1	11
—	4½

at this was not the
feet from the nose

and party on the

Feet.	Inches.
5	6
—	3
—	4
1	4
—	3½
—	1
3	5
4	7
—	8
—	6
—	9½
—	5½
4	1
—	7½

which the full details

Feet.	Inches.
1	5½
—	11½
3	10
3	2
1	6
1	1

CHAPTER XXVI.

THE BROWN BEAR OF EUROPE.

THIS animal closely resembles the Grizzly in its anatomical details; some old authorities have considered them as identical.

The following are the principal measurements of the Brown Bear skeleton, of which the full details are given in the table, Chapter L.

It is a small individual.

	Feet.	Inches.
Length of head in life	1	3
" " neck	—	10
Manubrium to ischium	3	2½
Height at shoulder	3	0
Width at acromions	1	0½
" " trochanters	—	10½

CHAPTER XXVII.

THE AMERICAN BLACK BEAR.

THE measurements of the commonest animals have proved the most difficult to get. No one seems to have thought it worth while to measure fully the Common Deer of America and of Europe or the commonest of the American Bears.

The skeleton in the Galerie d'Anatomie Comparée is as follows :—

	Feet.	Inches.
Length of skull	—	11½
" " head in life, estimated	1	1½
" " cervical vertebræ	—	10
Manubrium to ischium	2	11
Height at shoulder	2	3
From elbow to ground	1	3
Width at acromions	—	10½
" " trochanters	—	9

Audubon and Bachman give the following measurements of a 'very large' Black Bear:—'From nose to root of tail, 6 feet 5 inches; height to top of shoulder, 3 feet 1 inch.

'A larger Bear than the above may sometimes be captured, but the general size is considerably less.'

CHAPTER XXVIII.

THE POLAR OR WHITE BEAR.

ONE measured by order of Lord Mulgrave was as follows :—

	Feet.	Inches.
Length from the snout to the tail	7	1
" " " " " " shoulder bone	2	3
Height at the shoulder	4	3
Circumference near the fore-legs	7	0
" of the neck near the ear	2	0
Breadth of the fore-paw	—	7
Weight of the carcass without the head, skin, or entrails, 610 lbs (<i>Ord</i>).		

Dimensions of a Polar Bear, killed July 17, 1821, near Jan Mayen (see Manby's Journal).

	Feet.	Inches.
Length from snout to tail	7	6
Height of the shoulder	4	6
Circumference at the shoulder	6	11½
Breadth of fore-paw	—	11½
" " hind-paw	—	9½
Length of fore-claws	—	2½
" " hind "	—	2½
" tusks in upper jaw	—	2½

CHAPTER XXIX.

THE ANATOMY OF THE HORSE.

Plates XXVIII., XXIX., XXX., XXXI., XXXII., XXXIII.

If the domestic quadrupeds were ranged in a line according to their anatomical affinity, the Cat would probably be found at one end, and the Horse at the other. The Cat with eighteen toes, the Horse with but four; the Cat with its supple form, its manifold muscles, and its infinity of complex movements and positions, the Horse with its muscles and bones greatly reduced in number and its movements and positions almost limited to those required for mere locomotion.

The Horse's characteristic external features are so well known that they need not here be enlarged upon.

The skeletal differences on comparison with the Carnivores are sufficiently set forth by the Plates V., IX., XXVIII., XXX., and XXXI. It will be noticed on these that in the Horse the orbit of the eye is usually more prominent than the zygomatic arch; the male has canine teeth; the species has eighteen dorsal vertebræ, eighteen pairs of ribs, and but six lumbar vertebræ; the wings of the atlas are much developed, and form marked protuberances on each side of the neck; the scapula has little or no acromion, but at its upper end is a broad, strong cartilage, called the cartilage of prolongation, which virtually lengthens the scapula; it has no clavicle; its ulna and radius are fused, so that such acts as pronation or supination are impossible; its fibula is a mere rudiment; it has but one developed and two rudimentary metacarpals in each fore foot, and metatarsals in each hind foot; and each of its limbs is terminated in a single toe.

The muscles, with few exceptions, partake of the common tendency towards simplification. The panniculus is highly developed, in the living Horse the upper edge of its fleshy body forms a ridge which crosses the middle of the ribs obliquely backward and downward; the muscles for controlling the nostrils, the lips and the ears are more highly specialised than in the Dog; the zygomaticus does not reach the ear; the sterno-hyoid and sterno-thyroid are united; the superficial pectoral is divided into two distinct parts, the sterno-humeralis or anticus, and the aponeuroticus or transversus; the deep pectoral is divided in two parts, the sterno-trochineus and the sterno-prescapularis, the latter being attached to the fore part of the scapula; the deltoid and the flexor carpi ulnaris are divided in a peculiar manner; the extensor carpi ulnaris, and the special muscles of pronation and supination are absent.

On the hind-quarters, the gluteus medius is reduced, and the gluteus maximus greatly enlarged; the semitendinosus arises on the sacrum. There is a new large muscle called the vastus longus; this has been treated as the back part of the gluteus maximus, and also as the fore part of the biceps, it being formed of fibres derived from each, but most authorities separate it under the above name, as it has independent action; it arises on the sacrum and is inserted into the outside of the knee. The sartorius is small and inserted far back on the inside of the knee; the adductor magnus appears in two

separate
tendons o
limb belo
the fetloc
behind th
splint or
lower par
The
ancestor t
The
detail, exc
are the ar
subcutane
Ruminant
The
family.

separate parts, magnus and parvus ; there is but one peroneus on the leg ; the soleus is present ; the tendons of the perforans and perforatus are so close together as to appear like one mass or cord on each limb below the pisiform or the hough ; immediately next to the bone is the suspensory ligament of the fetlock—a flat, strap-shaped ligament which arises on the carpus (or tarsus) and passing downwards behind the bone is inserted into the summit of the sesamoid and into the toe. The point of the splint or rudimentary metacarpal (or metatarsal) bone forms the ridge that appears on each side of the lower part of each leg.

The chestnuts or warts on the insides of the limbs are no doubt relics derived from some remote ancestor that was provided with pads similar to those of the Camel.

The veins which show everywhere on the body of a thoroughbred Horse need not be treated in detail, excepting those large ones which are reasonably constant as features of the visible form. These are the angularis and facialis, of which the simplest types are represented in the plates ; the spur vein ; subcutaneous ; and the inner saphenous. The outer saphenous, so important in the Carnivores and Ruminants, is too minute in the Horse to need notice.

The ligamentum nuchæ becomes a structure of great size and importance, in the whole of the Horse family.

CHAPTER XXX.

THE SIZE AND PROPORTIONS OF THE HORSE.

Plate XXXIV.

ACCORDING to MM. Cuyer and Alix, Horses vary in height at the withers from 0·96 m. (about 37½ inches) to 2·10 m. (about 6 feet 10½ inches):

French Cavalry Horses are selected between 1·48 m. and 1·60 m. (about 4 feet 10½ inches to 5 feet 3 inches).

English Hunters vary from 1·55 m. to 1·62 m. (about 5 feet 1 inch to 5 feet 3½ inches).

Racers about the same or taller by 1 inch.

Heavy draught Horses from 1·65 m. to 1·75 m. (about 5 feet 5 inches to 5 feet 9 inches).

The following life-measurements were taken by the writer from an ordinary carriage horse, a gelding, of good form :—

	Feet.	Inches.
Length of head	2	0½
Thickness of head through zygomatic arches	—	9½
" " " orbits	—	9½
Depth of head	—	11½
Length of neck when erect	2	5½
Neck and body from occiput to insertion of tail	7	0
Ditto to point of ischium	7	4
Length of tail bones	1	8½
Total length from point of nose to point of ischium	9	4½
Height at shoulder	5	1
Length of ear	—	7½
" " " opening... ..	—	6
Width through external points of the iliac crests	1	8½
Width through at heads of humeri	1	3½
Girth of muzzle just behind the mouth	1	8½
" " " " " eyes	3	1½
" " " " " throat	2	6½
" " " " " base	3	7½
" " " " " chest just behind shoulder	5	8½
" " " " " belly at deepest point	6	0
" " " " " loins just before ilium	5	7
" " " " " arm at middle of radius	1	2½
" " " " " metacarpus at middle	—	8½
" " " " " leg at middle of tibia	1	4½
" " " " " metatarsus at middle	—	9½

The following are the life measurements of 'Sunlight,' a nearly thoroughbred English hunter of

admirable for
required for
His only
proportionate

Leng
Wid

Leng

"

"

Heig

"

"

Dept

"

Wid

"

"

"

"

Girth

"

"

"

"

Leng

Wid

"

The mea

The foll

a typical Ho

15, 28, 29,

The len

1. T

2. T

3. T

4. T

5. T

6. F

7. F

8. F

9. F

CHAPTER XXXI.

THE ASS OR DONKEY.

THIS animal agrees closely with the Horse in all essential features of its anatomy.

In its proportions it differs somewhat, especially in the size of its head.

All specimens examined by the writer go in a square of 2 heads. From the point of the occiput to the point of the withers is 1 head; the line of the breast just divides the height, *i.e.* it is 1 head from the ground; depth and greatest width of the belly, each 1 head; when the animal is standing the figure included between the fore-leg, breast, knee, and ground is a square of 1 head; the ear is half a head long.

In height, the Ass varies from 3 to 4 feet at the shoulder, although specimens of much greater size are occasionally seen. It is probable that the very large, thoroughbred Asses go in a square of $2\frac{1}{2}$ heads, for, as elsewhere remarked, the head is the least variable part of the anatomy.

Life Measurements of a Female Ass of Medium Size.

	Feet.	Inches.
Length of head	1	$9\frac{1}{2}$
Depth " " just before the eye	—	$10\frac{1}{2}$
Width " " at the orbits, the widest point	—	8
Length of ear	—	$10\frac{1}{2}$
From tip to tip of ears	1	10
From occiput to neural spine of first dorsal vertebra	1	10
" " " ischium	5	2
Total length from point of upper lip to ischium	6	$11\frac{1}{2}$
Length of tail (bone only)	1	2
Distance from manubrium to ischium	3	$7\frac{1}{2}$
Height at shoulder	3	$6\frac{1}{2}$
Depth of neck at throat	—	$10\frac{1}{2}$
" " " base	1	$2\frac{1}{2}$
Width of belly, at thickest part	1	7
Depth of belly	1	9
Width between the points of the shoulders	—	$10\frac{1}{2}$
" " crests of ilia	1	2
" " " ischia	—	9
Girth of chest	4	0
" " belly	5	$2\frac{1}{2}$
Elbow to ground	2	3
Calcaneum "	1	6
Belly	1	9
Knee to elbow (standing in ordinary position)	1	$9\frac{1}{2}$

CHAPTER XXXII.

THE ANATOMY, SIZE AND PROPORTIONS OF THE OX.

Plates XXXV., XXXVI.

IN most of its bony and muscular anatomy the Ox may be considered intermediate between the Horse and the Dog. The Horse has one toe on each foot, the Ox two (fully developed), and the Dog four or five; the Horse has fifteen or sixteen bones in each foot; the Ox nineteen or twenty; the Dog thirty-two or thirty-six. The Ox resembles the Horse in having the ulna and radius united into what is practically one bone, and the fibula a mere rudiment; but it resembles the Dog in having thirteen pairs of ribs, whereas the Horse has eighteen; all three animals have twenty-eight bones in the head, seven in the neck, and lack the clavicle. The Horse has eighteen dorsal or thoracic vertebræ, six or five lumbar vertebræ, and about sixteen tail bones; the Ox has thirteen dorsal vertebræ, six lumbar vertebræ, and about twenty tail bones; the Dog resembles the Ox in the number of its vertebræ, except that it has seven in the lumbar region. Notwithstanding the increased number of ribs and dorsal vertebræ, the Horse has in all but 191 bones to the Ox's 196, and the Dog's 255.

The Ox is a typical ruminant, the digestive system being peculiar and complex; and the teeth are very different from those of either Horse or Dog. They consist of twenty-four molars, six on each side of each jaw, and eight incisors in the lower jaw. There are no upper incisors, *i.e.* front upper teeth, their place being taken by a sort of pad, against which the lower incisors work.

The horns of the Ox form a striking peculiarity; their radical difference from the antlers of the Deer is noted elsewhere. The rudimentary hoofs which appear on each foot are but little more than appendages of the skin; for although they are attached to minute bones, the rudiments of toes, these latter are not perfectly articulated with the limb, as in the Pig, and have no proper muscles or tendons.

There are no remarkable departures in the great muscles of the trunk. The well-known pronounced conformation of the region about the loins, for instance, is merely the result of increased weight and size, an exaggeration of the elements of form found in Dog and Horse, without any important change in the constituent bones and muscles.

But on the limbs the intermediate character of the muscles, corresponding with the intermediate number of toes, is very obvious. On the outer side of the fore-arm and on the hind-leg we find much the same muscles as in the Dog, but more united, and with less independent action; the extensor communis, however, is peculiar in being split in two parts. The supinators and pronators are absent as in the Horse. On the thigh, the Ox has the vastus longus, like that of the Horse, and on the leg the peroneus longus, as in the Dog. It also resembles the latter in having the semitendinosus arising on the ischium.

The prominent veins of the face and limbs are like those of the Dog; but it agrees with the Horse in having the great spur vein on the side of the chest and belly.

A large
7 feet 8 inch
A small
head of an
The pr

The following life measurements were taken from a half-bred Shorthorn Bull of good form, a three-year-old, and from a French milk Cow of somewhat fuller body than that depicted in the plate of proportions (XL). The animals were standing in a normal position with the neck horizontal :—

	Bull		Cow	
	Feet.	Inches.	Feet.	Inches.
Length of head	1	10½	1	10½
Length of body from top of head in a straight line to the point of ischium ...	7	7	7	1
Length of neck; from head to sharp point of the first dorsal vertebra (this varies greatly with the pose)	2	4	1	11½
Length of tail to end of bone	2	8	2	1½
Height at shoulder	4	8	4	7½
Height of belly from ground	2	3	—	—
Width of head at widest part, <i>i.e.</i> , through the upper eyelids	—	11	—	9½
" " just above orbits	—	10½	—	7½
" " body from shoulder point to shoulder point	1	11	1	6½
" " belly	2	5	2	7½
" " through body from outside points of crests of ilia	1	10	1	11½
" " " extreme outer points of ischia	1	2½	1	3½
From back of ischium to front of iliac crest	1	11	1	11½
Length of ear	—	8½	—	9½
Girth of head just behind eyes	3	8	3	5½
" " chest	7	2	6	5
" " belly	8	0	8	9
" " fore-arm in middle	1	11½	1	4½
" " metacarpus in middle	—	9	—	7½
" " leg in middle of tibia	1	9½	1	9½
" " metacarpus in middle	—	9½	—	9½

A larger Shorthorn Bull, five years old, measured :—head, 2 feet; from top of head to ischium, 7 feet 8 inches; height at shoulders, 4 feet 10 inches.

A smaller Cow of Swiss breed measured :—head, 22½ inches; height, 4 feet 5 inches. The head of another Cow of less than average size was 20½ inches in length.

The proportions of the Ox are shown on Plate XXXVI.

CHAPTER XXXIII.

THE AMERICAN BUFFALO OR BISON.

Plate IV.

THE American Buffalo may be described as an Ox with the hind quarters somewhat reduced in size and the spines of the dorsal vertebræ elongated. This gives the animal a hump-backed appearance, especially in the case of the bulls in which the hump is usually much developed. The body is covered with wool, which is of great length on the head and the lower fore parts.

One frequently meets with allusions to the enormous size of the Buffalo's head, nevertheless apart from the wool it is found to be of the usual proportions. For the present purpose the length of the head is measured from the lower part of the upper lip, to a central point on a line 2 inches above the upper side of the base of the horns.

The animal goes in a square of $2\frac{1}{2}$ heads, but its hip-bone does not reach the line by $\frac{1}{4}$ head. In some bulls the discrepancy is greater, and in most cows it is less.

Dr. George Vasey gives the following measurements of a large male Buffalo.

	Feet.	Inches.
From nose to the insertion of the tail	8	6
Height at the shoulder	6	0
" " " croup	5	0
Length of head	2	1

According to Dr. J. A. Allen:—

'An adult male measures about 9 feet from the muzzle to the insertion of the tail, and $13\frac{1}{2}$ feet to the end of the tail, including the hairs, which extend about 15 inches beyond the vertebræ. The female measures about $6\frac{1}{2}$ feet from the muzzle to the insertion of the tail, and about 7 feet to the end of the tail, including the hairs, which extend about 10 inches beyond the vertebræ. The height of the male at the highest part of the hump is about $5\frac{1}{2}$ to 6 feet, of the female at the same point about 5 feet. The height of the male at the hips is about $4\frac{3}{4}$ feet, of the female at the same point about $4\frac{1}{4}$ feet. Audubon states the weight of old males to be nearly 2,000 lbs., that of the full grown fat females to be about 1,200 lbs.'

In chapter L. are given the bone measurements of a male Buffalo. The following additional measurements of the same skeleton will be found of service:—

	Feet.	Inches.
Length of skull	1	10
Estimated length of head in life	2	1
From top of head to point of longest (third) dorsal spine when the neck is horizontal	2	$10\frac{1}{2}$
From the point of the same dorsal spine to the end of the ischium	5	6
From a point on the spine opposite the iliac crests to the back of the ischium	1	$8\frac{1}{2}$
From manubrium to ischium	6	2
Total length from point of nose to end of body	10	$5\frac{1}{2}$

	Feet.	Inches.
Height at shoulder of skeleton	5	3½
" " " when alive (estimated)	5	10
Height from ground of central line of last cervical vertebra, <i>i.e.</i> where it leaves the body	3	6½
Distance from the last point to top of head	2	1½
From top of olecranon to ground	2	8½
" xiphoid "	2	1
" calcaneum "	1	9½
Width across orbits	1	1½
" through humeral heads	1	5
" " body at tenth rib	1	10½
" " external angles of ilia	1	10

The top of the scapula, even with the cartilage of prolongation, does not reach within six inches of the top of the longest dorsal spine.

CHAPTER XXXV.

THE BIGHORN.

(Ovis montana.)

THIS animal, though clad in hair like that of a Deer, is a true Sheep in all anatomical essentials. Ord (*N. A. Zoology*) quotes from Mr. M'Gillivray the following measurements of a male:—

	Feet.	Inches.
Length from the nose to the root of tail	5	0
„ of the tail	—	4
„ „ „ horn	3	6
Circumference of the body	4	0
The stand	3	9

He adds, 'A pair of these horns have been known to weigh 25 lbs.'

Audubon and Bachman give the following:—

	Feet.	Inches.
Male figure in our plate		
Length	6	0
Height at shoulder	3	5
Length of tail	—	5
Girth behind the shoulder	3	11
Height to rump	3	10½
Length of horn around the curve	2	10½
„ „ eye	—	1½
Weight 344 lbs., including horns.		

	Feet.	Inches.
Female figure in our plate.		
Nose to root of tail	4	7
Tail	—	5
Height of rump	3	4½
Girth back of shoulder	3	4½
Weight 240 lbs. (killed July 3rd, 1843).		

CHAPTER XXXVI.

POLO'S OR THE PAMIR SHEEP.

(Ovis polii.)

THIS magnificent animal was originally described by Marco Polo in the thirteenth century. The account of this explorer was discredited however until the animal was rediscovered in 1840 by Major Blyth, who found that Polo had understated, rather than overstated, the facts.

Blanford gives the following:—

Dimensions of an adult male with 48-inch horns.										Feet.	Inches
Height at shoulders	...	...	...	...	...	...	...	...	...	3	8
Length of head	...	...	...	...	...	...	...	...	...	1	1'25
From horns to tip of tail	...	...	...	...	...	...	...	...	...	5	2
Tail with hair	...	...	...	...	...	...	...	...	...	—	5'5
„ without	...	...	...	...	...	...	...	...	...	—	4
Length of ear in front	...	...	...	...	...	...	...	...	...	—	4'75
Girth round chest	...	...	...	...	...	...	...	...	...	4	3'5
										(Stoliczka).	
Basilar length of a good skull	...	...	...	...	...	...	...	...	...	1	0'7
Breadth across orbits	...	...	...	...	...	...	...	...	...	—	7'5

Females are not much smaller than males. Good horns of rams measure 50 to 60 inches round the curve, and about 15 inches in girth at the base, the extreme recorded measurements being 75 and 16'75. Severtzoff estimates the weight of an old male at about 600 lbs., but he did not weigh one.

The large pair of horns mentioned would thus have a total length around the curves of 12½ feet. A pair described by Sterndale was 54 inches across the tips, and another was 5 feet from tip to tip. The same authority gives the weight of an adult Polo Sheep at 576 to 612 lbs., the head and horns weighing over 72 lbs.

It agrees with the common Sheep in going in a square. But the height of the figure is increased from 2½ to 3 heads, a change of proportion elsewhere noted as characteristic of giant races.

CHAPTER XXXVII.

THE GOAT.

THE ordinary Goat, though so unlike in appearance, is of the same proportions as a Sheep, nor does its bony and muscular anatomy present important differences.

The following are the life measurements of a male Goat a year and a half old :—

	Feet.	Inches.
Length of head	—	10
Width " " across orbits	—	5
From point of lip to corner of eye	—	5½
" " " " front basil line of horns	—	8½
Length of ear	—	5½
From tip to tip of extended ears	1	4
Length of body, manubrium to ischium... ..	2	4
Height at shoulders (exclusive of hair)	2	3½
Neck from occiput to point of scapula	—	10
Total length point of lip to ischium	4	7
Tail bones	—	6
Girth of belly	2	11
Height of belly from ground	1	2
Distance from point of elbow to ground	1	1
Length from point of calcaneum to ground	—	11

CHAPTER XXXVIII.

THE GIRAFFE.

THE three living Giraffes measured by the writer were each 4 heads in height at the shoulder, and 2 heads in length of the body; the croup ¹ head lower than the withers; the neck 2 heads long. From the knee to the elbow was about 1 head; from the hough to the ground $1\frac{1}{2}$ heads; from the belly to the ground $2\frac{1}{2}$ heads.

The large male Giraffe in the Jardin d'Acclimatation is 21 feet high.

In the Galerie d'Anatomic Comparée is the skeleton of a male Giraffe which measures as follows:—

	Feet.	Inches.
Length of skull ...	2	$2\frac{1}{2}$
" " head in life, estimated	2	4
" " cervical vertebræ ...	5	$2\frac{1}{2}$
From manubrium to ischium ...	4	6
Height at shoulder ...	8	$7\frac{1}{2}$
" " " in life, estimated	9	3
" " iliac crest ...	7	0
From the highest point of the shoulders to the xiphoid	3	$9\frac{1}{2}$
" xiphoid to ground...	5	0
" olecranon to "	5	6
" calcaneum " "	3	6
" " " patella ...	2	7
" point of pisiform to ground	2	11
Width at humeral heads ...	1	$4\frac{1}{2}$
" of chest at widest part ...	1	10
" at trochanters ...	1	9
" iliac crests ...	2	$0\frac{1}{2}$

CHAPTER XXXIX.

THE PRONGHORNED ANTELOPE.

(Antilocapra americana.)

In its anatomy this unique animal bears a general resemblance to the Ox, Goat, and Deer tribes. One very evident difference is in the feet, the Antelope, like the Giraffe, having but two hoofs on each foot. Its horns are very remarkable, for although formed of true horn, as in the Ox, they are shed periodically as in the Deer.

A typical Antelope is $2\frac{1}{2}$ heads high and but 2 long. Richardson gives the following dimensions of a male Antelope :—

	Feet.	Inches.
Length from the nose to the root of the tail	4	4
Height at the fore-shoulder	3	0
" " haunches	3	0
Girth behind the fore-legs	3	0
" before " hind-legs	2	10
Length of the tail with the hair	—	4 $\frac{1}{2}$

According to this, the head of the animal would have been $14\frac{1}{2}$ inches long.

Judge Caton gives the following as the dimensions of an ordinary Antelope :—

	Feet.	Inches.
Length from nose to end of tail... ..	4	10 to 5 feet
Height at shoulder	2	10
" " hips	3	1
Length of fore-legs	1	6
" " hind-leg	1	10
" " ear	—	5

CHAPTER XL.

THE DEER FAMILY.

THE anatomy of the Deer corresponds closely with that of the Ox. The most striking difference is, perhaps, the antlers, which are borne by the males, and in the Caribou and Reindeer species by the females as well. These remarkable structures are of solid bone, and are grown and shed each year. The number of points on them has but little relation to the age of the animal; the finest antlers are grown by the finest bucks when they are in their prime; a very young, a very old, or an unhealthy buck always produces a poorly developed antler.

The Deer are also distinguished by the presence of a number of glands which secrete an unctuous matter that is supposed to be a means of intercommunication. At least two pairs of these merit notice:—the lachrymal pit or fossa under the inner corner of each eye, and the tarsal gland on the outer side of each hind-leg below the hough. The former by its size, colour, and shape is a marked feature of the face, and the latter on account of the hair-tuft around it gives a peculiar character to the hind-leg.

All of the true Deer measured by the writer go in a square of $2\frac{1}{2}$ heads, with 1 head or less for the neck, $1\frac{1}{2}$ heads for depth of belly, and 1 to $1\frac{1}{2}$ heads from hough to ground.

Some of the smaller Deer have a habit of drawing the hind quarters under them, so as to make the body short and very high at the back. In this position they of course do not make a square, although the height at the shoulders remains unaltered.

CHAPTER XLII.

THE RED DEER OF EUROPE.

(Cervus elephas.)

THIS is the Stag rendered famous by Landseer's pictures; it is much like a Wapiti in miniature. According to Bell (*Br. Quad.*), 'A fine Stag stands about 4 feet or even more.'

A medium-sized Stag at the Jardin des Plantes is 3 feet 8 inches at the shoulder. The does with him are about 4 inches lower.

According to Rev. L. Jenyns (*Br. Vert. An.*), the dimensions of the Stag are :—Length of body, 6½ feet; of the horns, about 2 feet; of the tail, 7 inches; height, about 3 feet 8 inches.

In the Galerie d'Anatomie Comparée is the skeleton of a male, which measures :—

	Feet.	Inches.
Length of skull	1	4½
" " head in life, estimated	1	7½
Actual length of cervical vertebræ	1	8½
From manubrium to ischium	4	0½
Height at shoulder	3	6
" " " in life, estimated	3	9
" " top of inner angle of ilium	3	4½
From xiphoid to highest point of shoulder	1	8½
" " " ground	1	11
" humeral head to ground	2	6½
" olecranon " "	2	0½
" patella " "	2	6½
" trochanter " "	2	11
" calcaneum " "	1	7
" " patella	1	3½
Width of skull at widest place, the posterior edge of the orbits	—	6½
" " shoulder at humeral heads	—	9½
" " chest at widest place, 11th rib	1	1
" " pelvis through iliac crests	—	11½
" " " trochanters	—	10½

Another fine skeleton in the same collection is as follows :—

	Feet.	Inches.
Length of skull	1	3½
" " head in life, estimated	1	7½
" " cervical vertebræ	1	6
From manubrium to ischium	3	7½
Height at shoulders	3	9
" " " in life, estimated	4	0
" " top of sacrum	3	8
From olecranon to ground	2	6
" calcaneum " "	1	9½
" xiphoid " "	2	2½

CHAPTER XLIV.

THE MOOSE AND THE EUROPEAN ELK.

MANY good authorities consider the Moose of America and the Elk of Scandinavia as one species. They differ considerably from the true Deer in their proportions, as well as in many details of their anatomy. The body is 2 heads in length and $2\frac{1}{2}$ heads in height at the shoulder. The neck is about half a head long, and the body through the belly 1 head deep; from the point of the hough or calcaneum to the ground is 1 head or rather more; and the distance from elbow to knee, when standing, is 1 head.

A Moose is from 5 feet 8 inches to 6 feet 6 inches at the shoulder, exclusive of the mane; 6 feet may be considered about the average height of a bull Moose.

Mr. John Rowley has given me the following measurements of a large bull Moose, shot by himself in New Brunswick:—

	Feet.	Inches.
Total length, end of muzzle to end of tail	8	2
Femur to humerus, <i>i.e.</i> , centre of head of humerus to centre of great trochanter	4	0
Height at shoulder, <i>i.e.</i> , from top of skin at hump to flat of hoof, with leg placed in a natural position, not outstretched, thus giving approximate standing height at shoulder	6	4
Height at rump, leg placed in natural position not outstretched, and measured from skin on rump to flat of hoof	5	9
Depth of body behind shoulder, from skin of back just behind hump to bottom of brisket	2	8
Greatest distance across horns	5	0

Measurements in all cases made with a tape in a straight line, not following the contour of the body.

According to Sir Henry Pottinger (*Badminton Library*):—

The average bodily measurements of a full grown Scandinavian Elk, let us say over seven years old, are as follows:—

	Feet.	Inches.
Length from tail to crest... ..	9	5
Crest to nose	2	5
Height at wither	5	8 to 9
At quarters	5	5, 6
From belly to ground	3	4
Greatest girth	6	11, 7 ft.
Round thigh	3	0
Round fore-arm	1	11

The following are the measurements of a male Elk, from Sweden. They were taken from the skeleton in the Galerie d'Anatomie Comparée:—

	Feet.	Inches.
Length of skull	2	0
Estimated length of head in life... ..	2	4
From top of head to point of longest (4th) dorsal spine, with neck horizontal	2	0
From same spine to back of ischium	4	1½

	Feet.	Inches.
Actual length of cervical vertebræ	1	8
From manubrium to ischium	5	2
Height at shoulder	5	7
" " in life	5	11
" " top of inner angle of ilium	5	2
From manubrium to highest point of shoulder	2	1½
" xiphoid	2	5½
" manubrium to ground	3	10
" xiphoid	3	1
" humeral head	4	1
" olecranon	3	5½
" patella	3	8
" trochanter	4	6
" calcaneum	2	6
Width of skull at widest place, the orbits	—	9
shoulder at humeral heads	1	1½
" chest at 11th rib (widest place)	1	10½
" pelvis through iliac crests	1	1½
" " trochanters	1	3

as one species.
f their anatomy.
out half a head
alcaneum to the
head.
e mane ; 6 feet

shot by himself

Feet. Inches.

8 2

4 0

6 4

5 9

2 8

5 0

Feet. Inches.

9 5

2 5

5 8 to 9

5 5 6

3 4

6 11 7 ft.

3 0

1 11

taken from the

Feet. Inches.

2 0

2 4

2 0

4 1½

CHAPTER XLV.

THE REINDEER AND THE CARIBOU.

(Rangifer tarandus.)

MOST authorities agree that the Reindeer and the Caribou are geographical races of the same species. They resemble the true Deer in general proportions and anatomy, their bodies going in a square of $2\frac{1}{2}$ heads, etc., but they differ in many details of form. The small ear and eye, the bovine character of the head and neck, the hairy muzzle and the great size of the hoofs and the horns are striking differences. But the fact that the great palmated antlers are also borne by the females, is one of the most notable distinctions between this and the other Deer.

The skeleton of a male Reindeer in the Galerie d'Anatomie Comparée, gave the following :—

	Feet.	Inches.
Length of skull	1	3
" " head in life, estimated	1	4
" " cervical vertebræ	1	$1\frac{1}{2}$
Manubrium to ischium	3	5
Height at shoulders	3	4
Width at humeral heads	—	$8\frac{1}{2}$
" " trochanters	—	$8\frac{1}{2}$
From calcaneum to ground	1	7
" olecranon " "	2	1

THE
many wide
The
each side o
knee; and
of thirteen
the seven
striking ch
The I
and general
For th
quite exha
The head
The ear is
Camel:
Th
Fu
Fo
Hi
Fu
Dromed
He
Fr
Fo
Hi
Fu
Dromed
He
Fr
Fo
Hi
Fu
In add
or Bactrian
Bactrian
He
Fr
Fo
Hi
Fr
The p

CHAPTER XLVI.

THE CAMEL AND THE DROMEDARY.

Plate XXXVIII.

THE Camel, while it resembles the Ox in the general arrangement of its bones and muscles, shows many wide anatomical differences, as well as the very obvious dissimilarity of general form.

The absence of horns and of accessory hoofs; the presence of tusks like canine teeth (three on each side of the upper and two on each side of the lower jaw); of callosities on the breast, elbow, and knee; and of the hump of reserve fat on the back; the small ear; the woolly coat; the twelve instead of thirteen dorsal or thoracic vertebræ with the accompanying twelve instead of thirteen pairs of ribs; the seven instead of six lumbar vertebræ; and the great length of neck and limb, are the most striking characteristics.

The Dromedary is merely a lightly built, swift Camel, bred for saddle use. Its bone measurements and general proportions are very similar to those of the Camel.

For those who wish to study the subject further, the monograph by Elijah Walton will be found quite exhaustive. The following measurements are taken from that volume:—

The head of a full grown Camel is from 1 foot 11 inches to 2 feet in length, and 1 foot across in the widest part. The ear is small, being only 4 inches in length by about 3 in width.

Camel:—

The head 2 feet long and 1 foot deep.

	Feet.	Inches.
Full length from shoulder to tail	5	8
Foreleg full length	4	4
Hindleg „ „	4	4
Full height from top of hump to sole of foot	7	0

Dromedary, male:—

Head, length, 1 foot 9 inches; width, 1 foot 2 inches.

	Feet.	Inches.
From shoulder to tail	4	11
Foreleg	4	0
Hindleg	4	0
Full height	6	6

Dromedary, female:—

Head, length, 1 foot 8 inches; width 1 foot

	Feet.	Inches.
From shoulder to tail	4	10
Foreleg	3	8
Hindleg	3	8
Full height	6	2

In addition to these, the same authority gives the following measurements of the large Two-humped or Bactrian Camel, in the Zoological Gardens at London:—

Bactrian Camel, female:—

	Feet.	Inches.
Head, full length	2	4
From shoulder to tail	6	1
Foreleg, equally divided at the wrist	3	2
Hindleg	3	2
From top of humps to the soles of the feet	7	5

The proportions of the Camel are indicated on Plate XXXVIII.

CHAPTER XLVII.

THE PIG.

IN the main features of its anatomy the common Pig agrees with the Ox tribe. It has, however, many more bones—about 270 to the Ox's 196; the greatest differences being in the limbs, where the Pig has four fully developed toes, with accompanying bones, to each foot, and the Ox but two. The muscular anatomy need not be studied in detail, as nothing but general masses are visible.

The large Pig skeleton at the Beaux Arts gives the following dimensions:—

	Feet.	Inches.
Skull	1	2½
Head in life about	1	4
Manubrium to ischium	3	10
Height at shoulders	2	8

This would give, as the life proportions, 2 heads in height at the shoulder, and 3 heads in length of body from manubrium to ischium.

A medium-sized female Pig of Essex breed measured as follows:—

	Feet.	Inches.
Head	1	0½
Length of ear	—	8½
Height at shoulder	2	1½
" " back	2	5
Body from manubrium to ischium	3	0½
Total length from occiput to ischium	3	9
Total length, nose " "	4	9½
From point of calcaneum to point of accessory hoof	—	10
From point of elbow to ground	1	1

THE n
Accor

The Indi
was 9 feet 10 i
but 10 inches

Sternd
mentions as

If the
to the poin
from the poi
enough to r

In the
dimensions v

Hei
Circ

Len

Measure

Len
Esti
Heig

"

Len

"

From

"

"

Heig

CHAPTER XLVIII.

THE INDIAN ELEPHANT.

THE males are usually 9 feet, and the females 8 feet at the shoulder.
According to Sanderson:—

The Indian Elephant does not reach a vertical height of 10 feet at the shoulder; the largest male out of some hundreds observed was 9 feet 10 inches, and the largest female 8 feet 5 inches. The calves at birth are usually 3 feet high at the shoulders, and have a trunk but 10 inches long.

Sterndale gives as a unique, authentic measurement of a male:—10 feet 7 inches at the shoulder, and mentions as a curious fact that twice around an Elephant's foot equals its height at the shoulders.

If the length of the head be taken from the crown between the ears to the point of the lower lip or to the point where the tusk first appears, the Elephant is $2\frac{1}{2}$ heads high at the shoulder, and 2 heads long from the point of the shoulder to the ischium. The ear is half a head long; the trunk more than long enough to reach the ground; from the breast to the ground about 1 head; the tail 1 head in length.

In the British Museum is the skull of a very large rogue Elephant that was killed at Meerut. Its dimensions were:—

	Feet.	Inches.
Height	10	6
Circumference of forefoot	5	3
" " trunk	4	$4\frac{1}{2}$
" " neck	13	6
Length from top of head to end of trunk	11	1

Measurements of the skeleton of the female Indian Elephant, in the Galerie d'Anatomie Comparée :—

	Feet.	Inches.
Length of skull from highest point of crown to extremity of bone of upper jaw	3	1
Estimated length of head in life, from crown to point of lower lip	4	2
Height at shoulder	8	6
" to top of inner angle of ilium, the only prominent point in the sacral region... ..	7	6
Length from manubrium to ischium	6	7
" of neck bones	1	4
From manubrium to highest point of shoulder, <i>i.e.</i> , the 3rd dorsal spine	3	6
" top of head to highest point of shoulder	3	$5\frac{1}{2}$
" xiphoid " " "	4	3
" highest point of shoulder to inner angle of ilium	4	3
Height of lower outer angle of ilium from ground	6	0

(N.B.—This angle is very important; it is the most prominent feature of the region, and disguises the trochanter.)

	Feet.	Inches.
Distance from same angle to line of ischiatic tuberosity	1	1
" of same angle in advance of centre of trochanter	—	8
" " " above the trochanter	—	8
(N.B.—The pelvis, as well as the limb bones, of the Elephant is remarkable for its perpendicularity.)		
From manubrium to ground	5	6
" xiphoid "	4	5
" shoulder-head "	5	1
" point of olecranon to ground	2	11½
" knee-cap "	2	7
" trochanter "	5	3½
" ischiatic tuberosity "	5	0
Width of skull at the widest point, viz., just above the opening of the ear	2	4
" " chest " " the 10th rib	2	4
" between the metacromions, the prominent external points of the shoulders	2	11
" " " heads of the humeri	2	7
" through the pelvis at the external angles of ilium	3	8½

This is
anatomy and
According

The Afr
forehead recede
measuring 10 f

Mr. R
Edinburgh,

This anim

His
fro
Gir
Fro
Cir
Fro
Len

The skull a

The ea
the Indian sp

Inches.
1
8
8

6
5
1
11
7
3
0
4
4
11
7
8

CHAPTER XLIX.

THE AFRICAN ELEPHANT.

THIS is a slightly larger animal than the Indian species, and, although quite distinct, of the same anatomy and nearly the same general proportions.

According to Sterndale:—

The African Elephant is of larger size as a rule, with enormously developed ears which quite overlap the withers. The forehead recedes and the trunk is more coarsely ringed, the tusks are larger.* * * Sir Samuel Baker had in his possession a tusk, measuring 10 feet 9 inches.* * * The African Elephant has only three nails on the hind foot, whereas the Asiatic has four.

Mr. Rowland Ward, referring to the large Elephant brought from Africa by H.R.H. the Duke of Edinburgh, says:—

This animal was undoubtedly one of the largest examples ever brought to this country, of the African species.

	Feet.	Inches.
His height at the withers was	10	0
From tip of trunk to tip of tail...	23	5
Girth	16	6
From top of the head to the end of trunk	11	3
Circumference of head	10	0
From ear to ear	9	0
Length of ear	4	6

The skull and tusks weighed more than 3 cwt. * * * The weight of the entire Elephant in the flesh was 4 tons, 8 cwt., 4 lbs.

The ears of the African Elephant, it will be seen, are 1 head long instead of half a head, as in the Indian species.

CHAPTER L.

MEASUREMENTS OF CERTAIN SKELETONS.

ACTUAL measurements in inches of certain skeletons which are in the normal position of the animal standing at rest.

All are from extreme points. The mark '?' means that the measurement, though taken as it stands, is not beyond question.

In the Herbivores given, the greatest width of the skull is at the orbits, not at the zygomatic arch as in the Carnivores, and the greatest width of the shoulders is at the humeral heads.

The Dog, Brown Bear, Horse, and Cow are in the museum of the École des Beaux-Arts at Paris. The Lion, Lioness, and Tiger, Grizzly Bear and Buffalo are in the Galerie d'Anatomie Comparée, Jardin des Plantes.

	SPECIES.	DOG.	LION.	LIONESS.	TIGER.	GRIZZLY BEAR.	BROWN BEAR.	HORSE.	COW.	AMERICAN BUFFALO.
	Remarks.	Large. Sex and breed unknown	Average specimen	Average specimen	Small specimen male	Sex ?	Sex ? Size, Medium.	Small male.	Above average size.	Large Male.
SKULL.	Length of skull from occipital tuberosity to alveolars of upper incisors ...	10½	13½	11½	12½	16	14½	20½	21½	22
	Length of head in life, i.e. allowing for nasal cartilages, &c. ...	10½	14½	12½	13½	17½	15	21½	22½	25
	Depth of skull at external orbital process of frontal bone at right angles to the long axis	4½	6½	5½	5½	7½	6½	10	10½	11½
	Width between alveolars of upper canines...	2½	3½	3½	3½	3½	3½	2½	—	—
	Greatest width (at zygomatic arches) ...	5½	9½	7½	9½	9	8½	—	—	—
	" " (at orbits) ...	—	—	—	—	—	—	7½	9½	13½
SPINAL COLUMN.	Length of cervical vertebrae ...	9½	11	10½	10½	11½	10	19½	19½	19
	Length of dorsal vertebrae from neck to a point opposite the front of the crest of the ilium	22	33½	26½	31½	31	25½	36	49½	54
	From level of iliac crest to back of ischium	7½	13	10½	12	15	12	16½	21½	21½
	From level of iliac crest to back point of sacrum ...	3½	7½	5½	6	10	8½	10½	13½	13½
	Length of sacrum ...	2½	4½	3½	3½	6½	5½	8½	10½	9½
	Length of caudal vertebrae...	—	40½	36½?	38½	6½?	4½	15½	32	20
TRUNK.	Depth of chest at xiphoid cartilage or metasternum ...	11½	13	12½	14½	20½	15½	24	29½	39½
	From iliac crest to centre of great trochanter	5½	8½	7½	7½	10	8½	12	15	14½
	Width from crest to crest of ilium at its widest point, i.e. the inferior external angle	5	6	6½	6½	14½	10½	18½	22½	20
	Width between ischiatic tuberosities, external points ...	5½	6½	6	6	8½	6½	9	15	12½
	Width at widest part of chest, i.e. about tenth rib ...	8½	10½	9½	10½	18	13½	18½	22½	22½
	Width from acromion to acromion, the widest point of shoulder ...	7½	10½?	9½?	10?	18	14	—	—	—
	Width from head to head of humeri, the widest point of shoulder ...	—	—	—	—	—	—	12½	18	17
	Width from trochanter to trochanter ...	7½	9½	9½	9½	13	10½	15	19½	19
	Height at shoulder when alive (estimated)...	29½	37	32	35	38	36	54	60	70
	From angle of scapula to crest of ilium ...	17½	25½	20?	22½	19½	17½	25½	36	36
	Length of body from manubrium to ischium (or from head of humerus to ischium) ...	30	44½	41½	45½	44?	38½	51½	70½	74

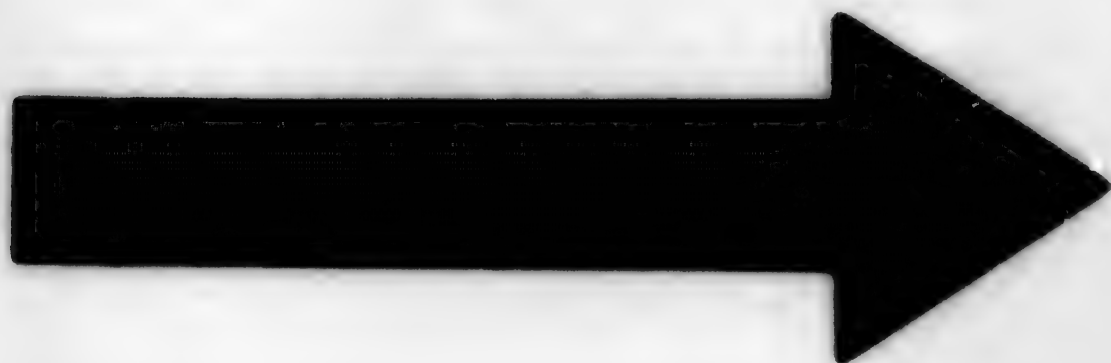
FORE LIMB.

HIND LIMB.

Leng
Leng
Leng
Leng
cer
Leng
tro
Leng
line
From
bor
Leng
From
of
From
tip

Great
From
out
Leng
From
bot
Leng
Great
From
out
From
of th

	SPECIES.	DOG.	LION.	LIONESS.	TIGER.	GRIZZLY BEAR.	BROWN BEAR.	HOASS.	COW.	AMERICAN BUFFALO.
	REMARKS.	Large, sex and breed unknown	Average specimen	Average specimen	Small specimen male	Sex ?	Sex ? Size, Medium.	Small male.	Above average size.	Large male.
FORE LIMB.	Length of scapula to tip of acromion process	6½	10½	8½	9½	12	9½	—	17½	17½
	Length of scapula to tip of coracoid process	7½	10½	9½	9½	11½	9½	14½	19½	20½
	Length of humerus on outer side ...	8½	13	11½	12½	15	13½	11½	10½	14½
	Length of humerus from centre of head to centre of external epicondyle ...	7½	10½	9½	10½	12½	11½	9½	10½	12
	Length of humerus inside from centre of the trochin to the centre of the tubercle ...	7½	10½	9½	9½	12½	11½	9½	10½	11½
	Length of ulna from top of olecranon to line of flexure of wrist ...	10½	14½	12½	13½	14	13½	16½	16½	17½
	From top of olecranon to point of pisiform bone ...	11½	14½	12½	14½	15	13½	17½	17½	17
	Length of radius inside ...	8½	11	9½	10½	12½	11½	13½	12½	12½
	From line of flexure of wrist to under side of outer sesamoid ...	4½	4½	4½	5½	4½	3½	10½	11	10½
	From point of outer sesamoid to level of tip of longest toe without hoof or claw	4½	4½	4½	5½	6	5½	7½	7	7½
HIND LIMB.	Greatest length of femur ...	9½	14½	12½	14½	17½	15½	15½	16½	17
	From centre of great trochanter to centre of outer tuberosity or epicondyle of femur ...	8½	13	11½	12½	15	13½	12½	13½	14
	Length of tibia to inner malleolus ...	9½	12½	11½	12	12½	11½	13½	14½	15½
	From centre of outer tuberosity of tibia to bottom of outer malleolus ...	9½	12½	10½	11½	12	11	12½	13½	13½
	Length of fibula ...	9½	11½	10½	11½	11½	10½	11	6½	—
	Greatest length of calcaneum ...	2½	4½	3½	4½	3½	3½	4½	6½	6½
	From top of calcaneum to under side of outer sesamoid ...	6½	9	8½	9½	7½	6½	15½	17½	17½
	From point of outer sesamoid bone to the tip of the longest toe without hoof or claw ...	3½	4½	4	4½	5	5½	7½	7½	7½



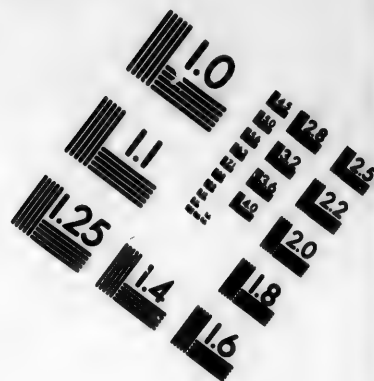
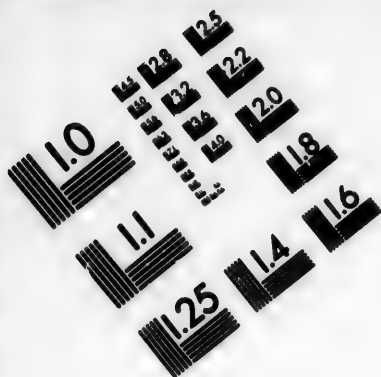
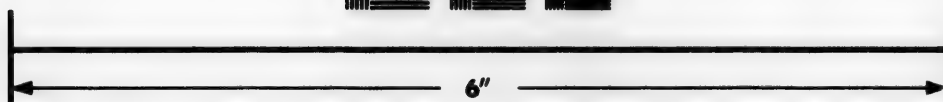
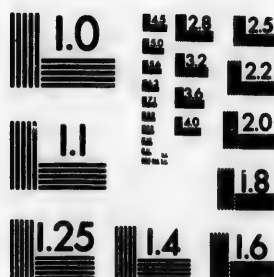


IMAGE EVALUATION TEST TARGET (MT-3)



Photographic
Sciences
Corporation

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

1.0
1.2
1.5
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
7.1
8.0
9.0
10.0
11.2
12.5
14.0
16.0
18.0
20.0
22.5
25.0
28.0
32.0
36.0
40.0
45.0
50.0
56.0
63.0
71.0
80.0
90.0
100.0

1.0
1.2
1.5
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
7.1
8.0
9.0
10.0
11.2
12.5
14.0
16.0
18.0
20.0
22.5
25.0
28.0
32.0
36.0
40.0
45.0
50.0
56.0
63.0
71.0
80.0
90.0
100.0

CHAPTER LI.

THE HORSE IN MOTION.

Plates XXXIX., XL., XLI.

THE positions in which artists were wont to represent quadrupeds in rapid motion have long been known to be merely conventional attitudes, with but little foundation in nature. Many original observers, John Leech, for example, made attempts to replace the conventional positions with others more true, but finally relinquished the idea as hopeless. The conclusion ultimately accepted by such men, was briefly this :—In every case art is a conventional abstract from nature, and its appeal to the imagination must necessarily be influenced largely by education. These impossible attitudes are through education able to suggest to us the idea of motion, and therefore they must be accepted.

Many other artists made attempts to draw nearer to the truth, but it was not until the appearance of the well-known Muybridge photographs, in 1878, that the matter was forcibly brought to the notice of the public and the whole art world. At first these photographs were looked upon merely as amusing curiosities, but their educational influence has steadily grown, and to-day it is the exception when one sees a running Horse depicted in the 'hobby-horse' attitude.

Being instantaneous photographs, their truth is beyond impeachment, and yet it is perhaps needless to remark that all truth is not equally good; and the artist who blindly and without judgment adheres to the attitudes shown is not likely to arrive at satisfactory results. The plates representing the walk, amble, trot, rack, canter, and gallop of the Horse are kindly loaned by Professor Eadweard Muybridge, whose definitions of these paces, as given in the Standard Dictionary, are reproduced by permission of Messrs. Funk and Wagnall of New York.

Walk. To move with the slowest pace, in which a quadruped has always two or more feet on the ground, and a biped always one foot. (Plate XXXIX.)

It is thus seen that when a Horse during a walk is on two feet, and the other two feet are suspended between the supporting legs, the suspended feet are laterals. On the other hand, when the suspended feet are severally in advance of and behind the supporting legs, they are diagonals. These invariable rules seem to be neglected or entirely ignored by many of the most eminent animal painters of modern times.

Amble. A method of progressive motion in quadrupeds, with the same sequence of foot-fallings as in the walk, but in which a hind foot or a fore foot is lifted from the ground before its fellow hind foot or fellow fore foot is placed thereon, the support of the body devolving alternately upon one foot and upon two feet, the single foot being alternately a fore foot and a hind foot and the intermedial supports the diagonal and lateral. (Plate XXXIX.)

The amble is natural to the Elephant, and, in some countries, to the Horse, the Mule and the Ass. The sequence of foot-fallings is the right hind, the right fore, the left hind, the left fore, beginning again with the right hind foot. At no time during the stride is the body of the animal unsupported.

The amble and the walk are the only regular progressive movements of the Horse wherein the body is never without the support of one or more legs; in all others the weight is entirely off the ground for a longer or shorter period.

Trot. A progressive motion of a quadruped, in which each pair of diagonal legs is alternately lifted, thrust forward, and placed upon the ground with approximate synchrony, the body of the animal being entirely unsupported twice during each stride. (Plate XL.)

It appears somewhat remarkable that until quite recently many experienced horsemen were of the opinion that during the action of the trot one foot of a Horse was always in contact with the ground.

Rack. The rack differs from the trot in the nearly synchronous action of the laterals instead of the diagonals. (Plate XL.)

Canter. A system of quadrupedal locomotion in which the feet are landed on the ground in the same consecutive order as in the walk, but at shorter or quicker comparative intervals of time. (Plate XLI.)

The canter is usually regarded as a slow gallop, probably from the facility with which a change from one gait to the other can be effected; an important difference will, however, be observed.

Gallop. The most rapid method of progressive quadrupedal motion (sometimes erroneously called the *run*), in which the animal springs into the air from a fore foot, and lands upon the diagonal hind foot. (Plate XLI.)

MANY
convention:
The f

The gall
the left fore,
the order beco

CHAPTER LII.

THE GALLOP OF THE DOG.

Plate XLII.

MANY of the attitudes assumed by a Dog at full speed, unlike those of the Horse, agree with the conventional attitudes which have been used indiscriminately to represent all quadrupeds when galloping.

The following is the definition in the Standard Dictionary :—

The gallop of the Dog differs from that of the Horse in that the sequence of foot-fallings is rotary instead of diagonal. The order is the left fore, the right fore, the right hind, the left hind, and then again the left fore; but this sequence is often reversed, so that the order becomes, the left fore, the left hind, the right hind, the right fore, and then again the left fore.

CHAPTER LIII.

THE ANATOMY OF BIRDS.

THERE is a widespread idea that the bodies of birds are everywhere and equally covered with feathers. This is far from being correct. All birds, with one or two exceptions, have large naked spaces on their bodies, covered however by the overlap of the feathers nearest, which would in many birds show an aggregate area nearly as great as that of the feathered tracts.

The first to call attention to this arrangement of feathered tracts, or Pterylæ, and bare tracts, or Aptería, was Nitsch.

In the general plan of pterylosis that he lays down we find the following feather-tracts named :—

1. The Spinal tract, extending on the back from the nape to the tail ; extremely variable.
2. The Humeral „ narrow bands, one on each arm across the humerus.
3. The Femoral „ similar to No. 2, one across each thigh.
4. The Ventral „ begins at the head and passes along the under surface to the tail ; extremely variable.
5. The Capital „ covering the head.
6. The Alar „ the rest of the wing feathers.
7. The Caudal „ the tail and its region.
8. The Crural „ the leg feathers.

The importance of these tracts to the artist lies in the fact that the series of feathers which emanate from them are separately visible in the plumage of the living bird. And when drawing is made with due reference to these anatomical considerations, it wears an air of truthfulness which all recognise, even though they do not know the reason for it. Hitherto no one seems to have considered these facts to be worthy of the artist's notice, excepting the sculptors and painters of ancient Egypt, ancient Assyria, and Japan. In the last country the love of nature and truthful rendering of it has continually kept alive the study of feathers, as is abundantly attested by the exquisitely artistic and truthful representations of the Shijo, or Naturalistic School. Mr. Goodchild, in his able paper on the Cubital coverts of Birds, points out the peculiar character of the wing feathering of the Hawk tribes, and adds :—

The wing of a Merlin well illustrates the whole of the normal Acciptrine forms. Mr. Wolf's beautiful figures of the Birds of Prey all afford excellent illustrations of the same point, while, from a part of the world where experience has led us to expect minute accuracy of detail, we have the Japanese figure in metal of a species of *Spizæetus* now among the choicest treasures at South Kensington Museum which affords a correct illustration of the Acciptrine style of cubital coverts.

This figure is the work of Miyôchin Munéharu, an artist of the sixteenth century. In the same room is a bronze incense-burner of nineteenth-century work, decorated with life-sized Peafowl and Pigeons, which also affords equal evidence of artistic feeling and scientific accuracy carried to the highest pitch.

In our own time and country the bird drawings of Wolf, Keulemans, and Thorburn are among the best studies extant in this field. Mr. Wolf, indeed, may be called the founder of the London School. As early as 1840 he made a series of Falcon studies which are among the classics of the subject.

While Wolf was treating artistically the study of feathers, Sundevall was making purely scientific

investigation
which the

(1) *Wing*
and are the large
(2) *Large*
inserted in the
(3) *Second*
that they lie in
(4) *Small*
seated). They
They are want
(5) *Arm-*
rows upon the

1. *Remige*
In numbers the

The num
this because the
ensis and *phillip*
and *Corythæ*,
The typic

to the hand, t
gradually shorte
of the Water-b

In those w
In the Sor

and in this latte
quite usual. V
rudimentary, o
the first feather

2. *Remige*
that the root-er
the wing is fol
diminished in s
and both in for

In numbe
The number is
number in the
10-13, but in
nearly constant

1. *Tectric*
upon the ro
corresponding
after their quill
arm *cubitalis* (g
so close upon t

The great
Of the *T*
small supernu
(rows of three
therefore, to sh
the Song-birds
other orders the

2. *Tectric*
ordinary feather
greater coverts
the next one.

investigations in the same department, and in 1847 published a paper on the 'Wings of Birds,' from which the following extracts are taken:—

(1) *Wing-quills* (Pennæ alares, Remiges, Linn. and Ill.) are only a single row, which are seated in the posterior margin of the wing, and are the largest of all. All the others are usually named *coverts* (tectrices).

(2) *Large coverts* (Tectrices majores, Pteromata, Ill.), a series of feathers which lie immediately over the roots of the quill-feathers, inserted in the skin behind the muscular layer.

(3) *Second series of coverts*, which are also seated in the fold of skin behind the true arm or hand. They often show the peculiarity that they lie in a reverse position to the preceding, as to which more hereafter.

(4) *Small coverts* (Plumæ or Tectrices minores, brachiales, cubitales, digitales, so named according to the part upon which they are seated). They form from three to five series, and are placed upon those parts of the skin which enclose the bones and muscles of the limb. They are wanting upon the cubitus in all birds which possess singing muscles at the lower larynx, but occur in all other birds.

(5) *Arm-fold feathers*, or the anterior small feathers of the wing (Plumæ antecubitales, or Tectrices minimæ), are seated in several rows upon the fold of the skin in front of the arm itself.

1. *Remiges primores* ("lash-feathers"), which are seated upon the hand, constitute the most important part of the organ of flight. In numbers they are usually ten.

The number of the feathers varies but little; only between 9 and 11. There are 9 of them only in some Song-birds, and this because the first feather disappears (of which more hereafter); and 11 in the genera *Podiceps* (all the Swedish species, also *P. dominicensis* and *philippensis*), *Phoenicopterus*, *Anastomus*, *Tantalus*, *Ciconia* (according to Nitsch, also *C. mycteria*, but not *C. argala*), *Musophaga* and *Corythæix*, but not in *Schizorhix*, Wagl.

The typical form seems to be that all the 10 feathers are of equal length; but in consequence of the way in which they are attached to the hand, the first feather projects beyond the following ones and thus seems to be the longest, while the following ones appear to get gradually shorter. The wing then is quite acute. This form of wing occurs generally among the lower birds, namely, in a great many of the Water-birds.

In those which fly with remarkable rapidity, the second feather is usually the longest.

In the Song-birds without exception, the first feather is abbreviated.*** It either remains as a small rudiment, or entirely disappears; and in this latter case there are only nine primaries. This reduction of the first feather is peculiar to Song-birds, but among them it is quite usual. We may indeed estimate that one fourth of the known species are destitute of the first quill-feather, one fourth have it rudimentary, one fourth have short rounded wings with ten primaries, and the remaining fourth have tolerably long wings, but with the first feather shorter than those that follow.

2. *Remiges cubitales*, or Pennæ cubitales (arm-feathers), are inserted in the fold of the skin along the posterior side of the ulna, so that the root-ends always rest against the outer side of that bone.*** Most of them are nearly of the same size and structure, so that when the wing is folded the inner ones usually extend gradually beyond the outer; but a few of the innermost, 2-5, are always gradually much diminished in size, and have frequently a different colour and structure from the rest. They are in this case softer, more pointed, &c., and both in form and colour resemble the feathers of the back.

In number the cubital quill-feathers vary very considerably, namely, between 6 (in *Trochilus*) and 36-40 (in *Diomedea exulans*).*** The number is in general greatest in Water-birds, some of the Waders (*Ardea*, *Ciconia*) and Raptorial birds (*Vulturina*). The average number in the other Raptorial birds, Gallinæ, and Waders is 15-16, which also occurs in many Water-birds; most of the Cocyges have 10-13, but in these, as in all the fore-named orders, the number varies, even in species of the same genus. Only the Song-birds have a nearly constant number, 9, which is the smallest number of general occurrence.

1. *Tectrices majores* (great wing-coverts, Pteromata, Ill.) form a single series, which is always situated immediately within upon the roots of the quill-feathers. They always retain much resemblance in form, texture, and colour to their corresponding quill-feathers, and are always, like the latter, destitute of accessory plumules. They should be named after their quill-feathers, so that those on the hand are called *Tectrices primores* or manus (great hand-coverts), and those on the forearm *cubitales* (great arm-coverts). The former are always inserted in the skin in the same tube with their corresponding quill-feathers, and so close upon the latter that the two seem to have grown together.

The greater hand-coverts (*T. majores primores*) are equal in number to the quill-feathers.

Of the *Tectrices cubitales* there are always one or two more than of the corresponding remiges; thus, externally, there is always one small supernumerary one. Properly, they ought to be of equal number, as the feathers here, as everywhere, are arranged in quincunx (rows of three different sets), which constitutes a continuation of their arrangement on the hand. The supernumerary coverts seem to me, therefore, to show that a quill-feather, which ought to have been placed in the middle of the wing-fold, is not developed.*** In the Song-birds they are so short that they do not attain half the length of the remiges, except inwardly in some genera; but in all other orders they are larger, so that they always reach beyond the half of their corresponding remiges.

2. *Tectrices secundæ seriei* (the coverts of the second row), which lie immediately upon the greater coverts, generally resemble the ordinary feathers of the body. Those which belong to the cubitus have usually the peculiarity of lying reversed with relation to the greater coverts and remiges, so that the inner margin of each feather (that turned toward the humerus) is free and covers the outer margin of the next one. But I have always found them unreversed in *Trochilus*, *Coracias*, *Cuculus*, *Columba*, *Gallus*, *Lestris*, *Sterna*, and *Uria*, as

well as in young Song-birds in their first dress.*** They are most visible in the Oscines, in consequence of the absence of the next series, and are quite short, soft, and usually distinguished by a peculiar colour-marking, e.g., white at the apex in many so that they form a transverse band upon the wing. (A transverse band upon the wing is almost still more frequently produced by the apices of the greater covert feathers, which in the Song-birds, are often white, yellow, or of paler colour.)*** In the Song-birds, in which they alone are reversed, they may receive this name (*perverisæ*).

3. The *Tectrices minores cubiti vel manus* (smaller wing coverts) in form do not differ at all, or but slightly, from the feathers of the body, and in position they agree with the next preceding series, inasmuch as their margins cover each other in a contrary way to those of the remiges. But they lie similarly reversed also in those birds in which those of the second series are not reversed (*Coraciis, Cuculus, &c.*).

In the Song-birds these feathers should properly form three series on the cubitus, but they show the remarkable peculiarity that they are never fully developed. Only in the young in their first plumage, and in the winter plumage, a few of them, but never all, occur in the form of down, or of very small undeveloped feather rudiments covered up by the next following perfect feathers. In older birds in the summer plumage, scarcely a trace of them is usually visible.

This remarkable structure is so peculiar to those birds which have the inferior larynx furnished with five pairs of muscles, that I have been unable to find any other form except *Cypselus* which resembles them in this respect, but it occurs in the whole of them without a known exception, and, consequently, forms a certain external character for them. In every Song-bird, even when sitting with folded wings, and in stuffed specimens, we recognise this deficiency at the first glance: it causes the wing to exhibit only a small number of coverts, and these to occupy an inconsiderable space in comparison with those in the wings of species belonging to other orders.

On the hand these feathers are continuous in two or three series, which in no respect differ in structure from the second series of coverts, and exactly cover the small portion of the hand which is not clothed by the large coverts. They are usually concealed by the quill-feathers of the thumb, and always lie right, i.e., not reversed as on the cubitus.

4. The *Tectrices minimæ s. antecubitales* (smallest or foremost covert-feathers), are seated in several series upon the fold of the skin in front of the cubitus. They are right-lying, not reversed like those on the cubitus itself. But we often find one of these series reversed, in agreement with the preceding ones, e.g., in the Gallinæ, in the diurnal and nocturnal Birds of Prey, and many others.

On Plate XLIII. is shown the Common Sparrow, its ordinary appearance, and a chart of its feather arrangements. These are explained by the drawings on Plate XLIV., and will serve to illustrate the feathering of all the Passerine Birds.

Plates XLV. and XLVI. present the living appearance and anatomical details of a Kestrel, as a type of the Birds of Prey.

Plates XLVII. and XLVIII. give the natural appearance, abstract form, feather arrangement, and living details of the Common Quail (*Coturnix communis*).

COMMON
recently disc
Pheasants b
none of the
else as beau
The tr
The chrom
displayed.
ment of fea
will be seen
The ex
Sparrow (Pl
neath the tr
feathers of
lengthening
mathematic
A sligh
rows or Y
interval. T

CHAPTER LIV.

THE PEACOCK.

Plate XLIX.

COMMON opinion has awarded to the Peacock, above all birds, the palm of beauty. Many of the recently discovered Hummingbirds are exquisite, as are the rare Birds of Paradise and some of the Asiatic Pheasants brought to light by modern research, but, divested of their charm of novelty, it is found that none of the species mentioned can successfully compete with the Peacock. Probably there is nothing else as beautiful in the world of Zoology.

The train, or 'tail' as it is commonly called, is the unique and splendid feature of this regal bird. The chromatic beauties are no less notable than the mathematical correctness with which they are displayed. It is almost unquestionably the most remarkable illustration extant of the regular arrangement of feathers. The perfect geometric design, indicated in the Plate, is not merely hypothetical, but will be seen in every Peacock's 'tail' when in full plumage.

The explanation of this is very simple, as will be seen on reference to the drawing of the naked Sparrow (Plate XLIV.). The true tail of the Peacock, composed of eighteen ordinary feathers, is underneath the train and supports it when spread. The train consists of two hundred and fifty odd posterior feathers of the dorsal tract, which are set on in diamond pattern, as in the Sparrow, and the regular lengthening of which towards the back, together with the radiation when spread, completes the mathematical figure.

A slight variation is sometimes seen when the tail is newly grown. The ends of the three outer rows or Υ feathers are close together and separated from the true eye feathers by an exceptionally wide interval. They are also supplied with an embryo eye, which however is soon worn off.

A LIST OF THE PRINCIPAL WORKS CONSULTED.

1683. **SHANE (ANDREW).** *The Anatomy of an Horse.*
With copperplate illustrations. A careful description, afterwards translated into French by F. Garsault, 1732.
1766. **STUBBS (GEO.).** *The Anatomy of the Horse.* In eighteen tables, all done from nature. London.
The plates were engraved by the artist himself, and are among the most accurate anatomical illustrations extant.
1769. **BOURGELAT (CL.).** *Elémens de l'Art Vétérinaire.* [Traité de la Conformation extérieure du cheval, &c.] Paris.
The anatomy of the Horse compared with that of the Ox and Sheep. 4th edition in 1807.
1779. **GOIFFON ET VINCENT.** *Memoire artificielle des principes relatifs à la fidelle representation des Animaux, tant en Peinture, qu'en Sculpture.* Alfort. Folio.
With 23 large copperplates showing accurately the action, anatomy, size, and proportions of the Horse.
- [1799.] **GIRARD (J.).** *Tableaux Comparatifs de l'Anatomie des animaux domestiques.* VII. de la République.
1807. **GIRARD (J.).** *Anatomie des animaux domestiques.* 8vo, 2 vols. (4th ed., 1841.)
Translated into German by K. L. Schwab, 1810-11.
1822. **GURLT.** *Handbuch der Vergleichenden Anatomie de Haussaugethiere.*
With atlas of plates. 2nd edition 1832; 3rd edition 1844.
1832. **PERCIVALL (WM., M.R.C.S.).** *The Anatomy of the Horse.* London. 8vo.
No illustrations.
1843. **SUNDEVALL (C. J.).** *On the Wings of Birds: The Ibis, fifth series, vol. iv., No. xvi. art. xxxix. pp. 389-457.*
Plates ix. and x. [Translated from the original Swedish of the Kongl. Vetensk.-Akad. Handlingar, 1843, by W. S. Dallas, F.L.S.] London, 1886.
Two plates, comprising 13 valuable illustrations. This is the first attempt to study the subject.
- 1844-53. **SCHLEGEL (H.) et VERSTER DE WULVERHURST (A. H.).** *Traité de Fauconnerie.* Leiden and Düsseldorf.
With 12 life-size plates by J. Wolf.
1845. **STRAUS-DURCKHEIM (HERCULE).** *Anatomie descriptive et comparative du Chat.* 2 vols. text, 4to, 1 atlas folio. Paris.
Atlas with 13 admirable plates, $\frac{3}{4}$ life-size.
1847. **NITSCH (C. L.).** *Systeme der Pterylographie.*
The first edition was published in 1833. The English translation by Dr. P. L. Sclater, in 1867.
1850. **LEVY (F. A.).** *Handbuch der Anatomie der Hausthiere.* Stuttgart. 8vo. 2nd edition, 1859.
Excellent treatise on Anatomy of Horse, Cow, Pig, Cat, and Dog, with careful woodcuts.
1861. **LEISERING (A. G. T., Dr.).** *Atlas der Anatomy des Pferdes und Übrigen Hausthiere.* [Drawings by Moritz Krantz.]
Valuable lithographic plates of Horse, Cow, Dog, Cat, Birds, &c.
1865. **WALTON (ELIJAH).** *The Camel: its Anatomy, Proportions, and Paces.* London. Folio.
Ninety-four large lithographic plates by the author, many of them coloured. A most valuable work.

1870. FLOWER (W. H.). Introduction to the Osteology of the Mammalia.
1873. MAREY (E. J.). *La machine animale. Locomotion terrestre et aérienne.* Paris. 8vo.
The locomotion of animals studied by mechanical apparatus; 117 figures in the text. Followed some years later by works with instantaneous photographs.
1880. REGAMEY (GUILLAUME). *Atlas de l'Anatomie des formes du Cheval.* Paris.
With chromo-lithographic plates.
1881. MIVART (ST. GEORGE). *The Cat.* New York. 8vo.
1882. STILLMAN (DR. J. D. B., A.M.). *The Horse in motion. Under the auspices of Leland Stanford.* London.
One hundred and seven plates, chiefly from photographs by Mr. Ead. Muybridge, illustrating the Horse, Ox, Dog, Pig, and Deer in motion.
1883. FRANCK (DR. LUDV.). *Handbuch der Anatomie der Haustiere.* Stuttgart. 8vo.
1884. GOUBAUX (A.) et BARRIER (G.). *De l'extérieur du Cheval.* Paris.
A valuable work with 34 plates and 346 illustrations. A second edition appeared in 1890.
1885. LEISERING (A. G. T.) und MUELLER (C.). *Handbuch der vergleichenden Anatomie der Haussaugethiere.* Berlin. 8vo.
A new edition of Leisering's work (1861).
1886. CUYER (E.) et ALIX (E.). *Le Cheval.* Paris.
Sixteen large coloured plates, with superimposed parts and many woodcuts.
1886. GOODCHILD (J. G.). *Obs. on the Cubital Coverts of Birds.* P. Z. S. Pp. 184-203. London.
Thirty-seven cuts.
1887. MUYBRIDGE (EADWEARD). *Animal Locomotion.* Philadelphia, 1872-1885.
Ten folio volumes, containing 781 plates, each representing a series of movements of Man, Birds, or Animals.
1890. BALLU (Roger). *L'Œuvre de Barye. Précédé d'une introduction de M. Eugène Guillaume.* Paris. Folio.
An important work, with 25 large plates, including portrait of Antoine Louis Barye, and 51 wood-cuts.
1891. ELLENBERGER (DR. W.) und BAUM (DR. H.). *Systematische und topographische Anatomie des Hundes.* Berlin.
An admirable monograph, with 208 cuts, 37 lithographs.
A French translation by Dr. J. Deniker appeared in 1894, published by C. Reinwald and Co.
1891. CHAUVEAU (A.). *The Comparative Anatomy of the Domesticated Animals.* Revised by S. Arloing. Translated by Geo. Fleming. New York. 8vo.
First edition (French) dated 1855. First English edition 1864.
1892. GOODCHILD (J. G.), H.M. Geol. Surv., F.Z.S., M.B.O.U. *The Cubital coverts of the Euornithes in Relation to Taxonomy.* Proc. Roy. Phys. Soc. Edinburgh, 1890-91. Vol. x. Plate xv., 17 pp. 317-333 pp.
One plate with 26 figures of wings.
1892. (*Idem*). *Notes on Crested Birds of Prey.* Same publication, pp. 202-208. Plate x.
One plate with 13 figures of heads.
1893. (*Idem*). *Supplementary Observations on the Cubital Coverts of the Euornithes.* Same publication. Vol. xii. (1892-3), pp. 171-181.
1894. SUSSDORFF (M.). *Lehrbuch der vergleichenden Anatomie der Haustiere.* 2 vols.
An important work, with very accurate illustrations.

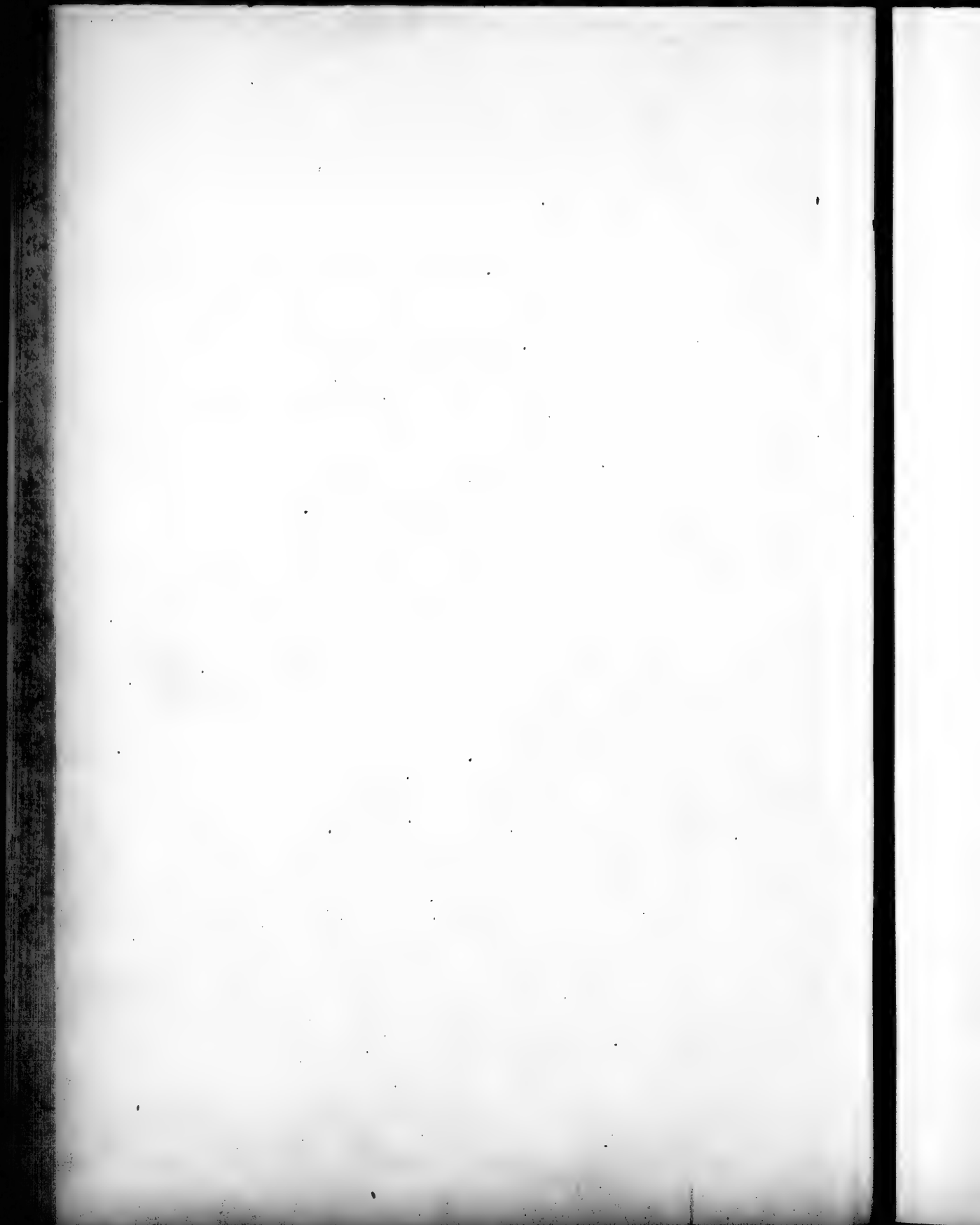
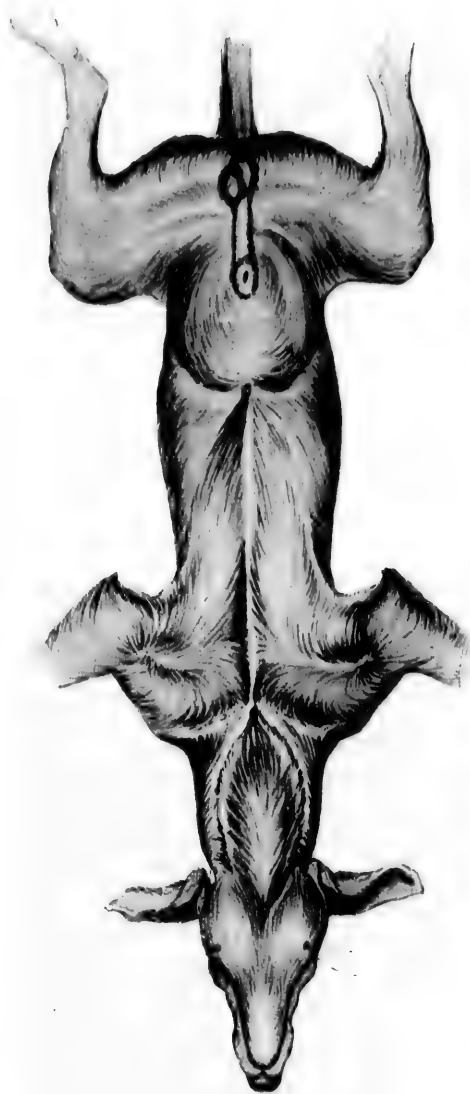




PLATE I.—DIAGRAM OF A WOLF.
To illustrate the Anatomy of the Hairy Coat. (See Chapter II.)





Edward S. Humphrey



PLATE II.—DIAGRAM OF THE HAIR ON THE BELLIES OF DOG AND CAT.
To illustrate the plan prevailing throughout the Mammalia. (See Chapter II.)



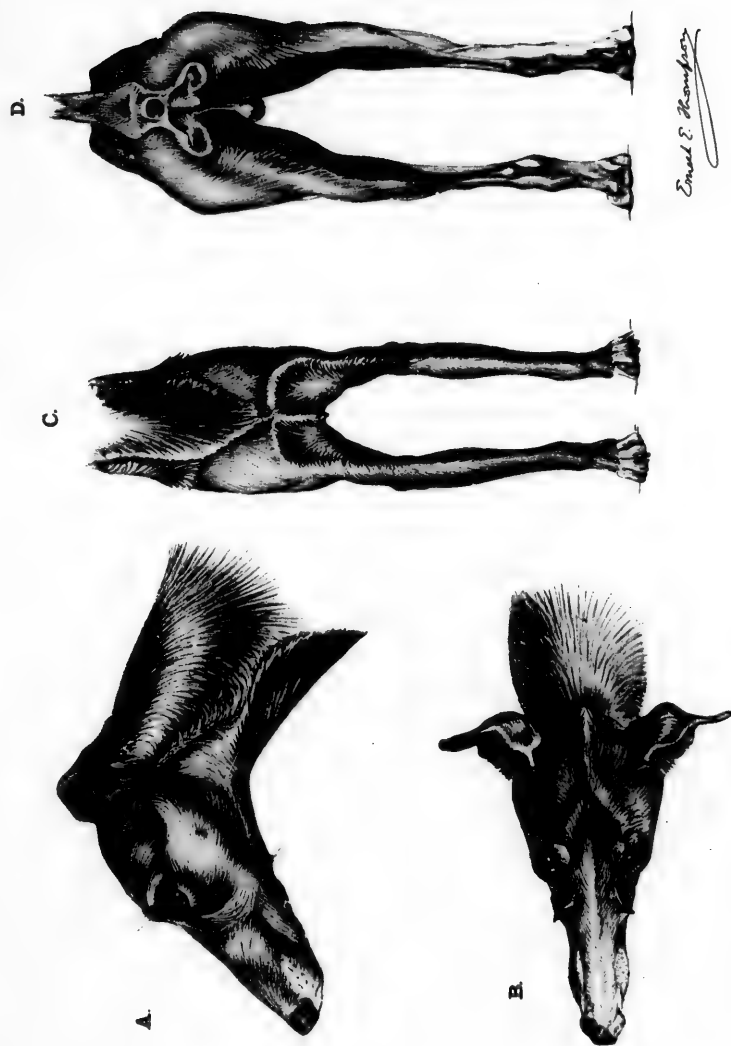


PLATE III.—THE ARRANGEMENT OF HAIR ON THE GREYHOUND.

To show the prevailing general plan, especially the various "Structural Scar" and the Ridge caused by the radiating Hair around the Eyes meeting the Hair on the Nose.
(See Chapter II.)

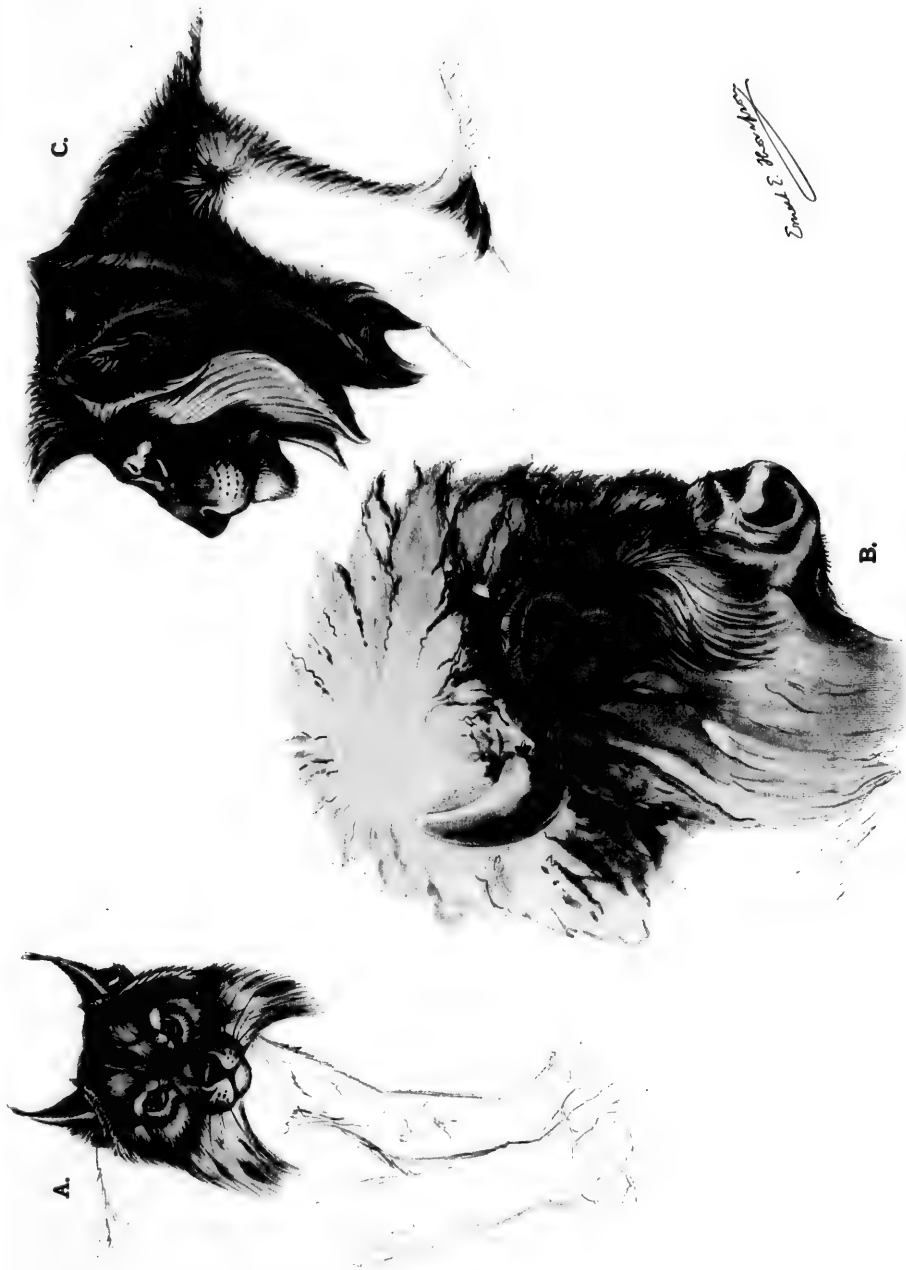


PLATE IV.—HEADS OF LYNX, AMERICAN BUFFALO, AND LION.

A. Head of Canada Lynx, to show the development of the Check Ruff and the partial development of the Ear Ruff.

B. Head of American Buffalo, to show the divergent Hair about the Eyes.

C. Head of Lion, to show both Ruffs at full development, also the arrangement of the Mane. (See Chapter II.)



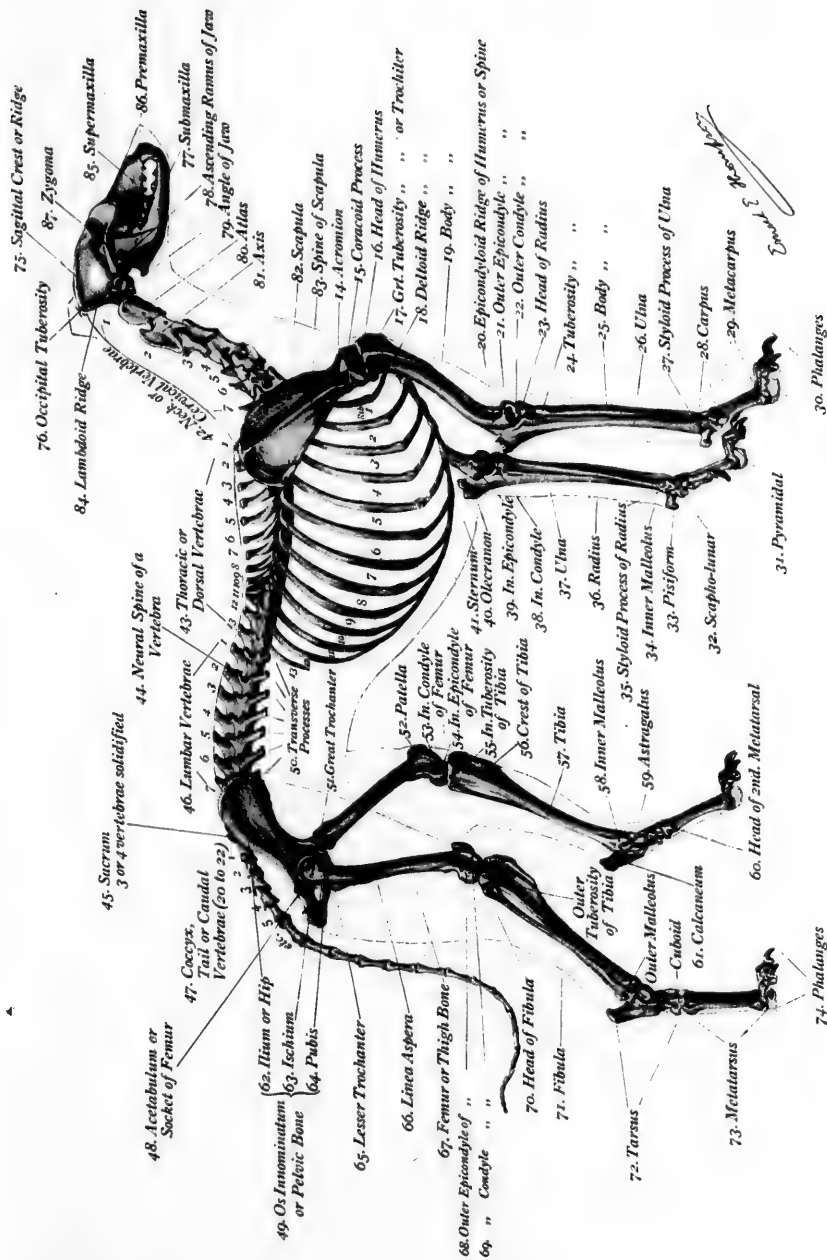


PLATE V.—THE ANATOMY OF THE GREYHOUND. THE SKELETON.
For the sake of simplicity, the Ribs and Shoulder-bones of the farther side are omitted.

1. Occ. Tub.
2. Sag. Crest
3. Opilit. Proc.

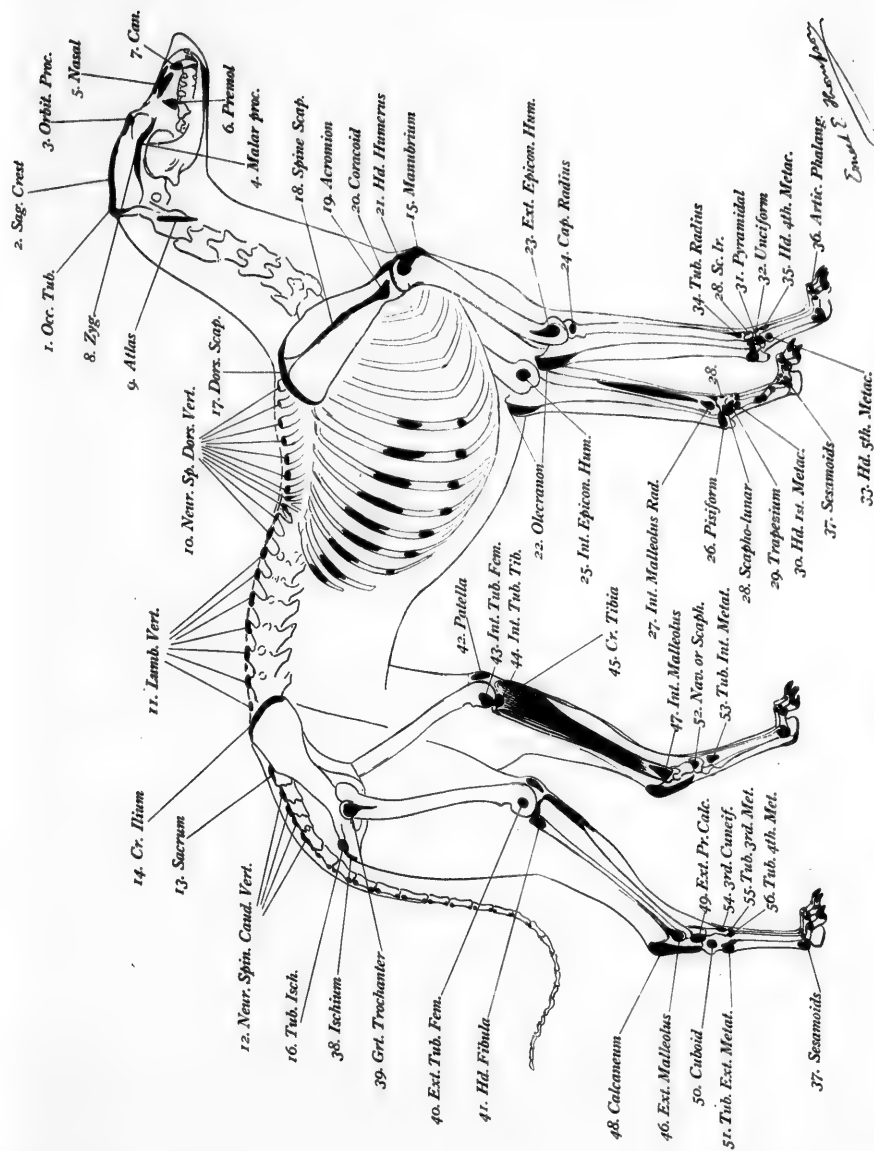


PLATE VI.—THE ANATOMY OF THE GREYHOUND. THE BONE POINTS.

The black places show where the bones come to the surface nearly enough to make visible points or bosses, supplying fixed points for definite measurements. (See Chapter VIII.)

11. *Mandibulum or Presternum*



13. *Sternum or Breast-Bone composed of 8 Parts or 8*

B.

18. *Zygomatiscus major*

19. *Scularis*

20. *Maxillaris or Lev.*



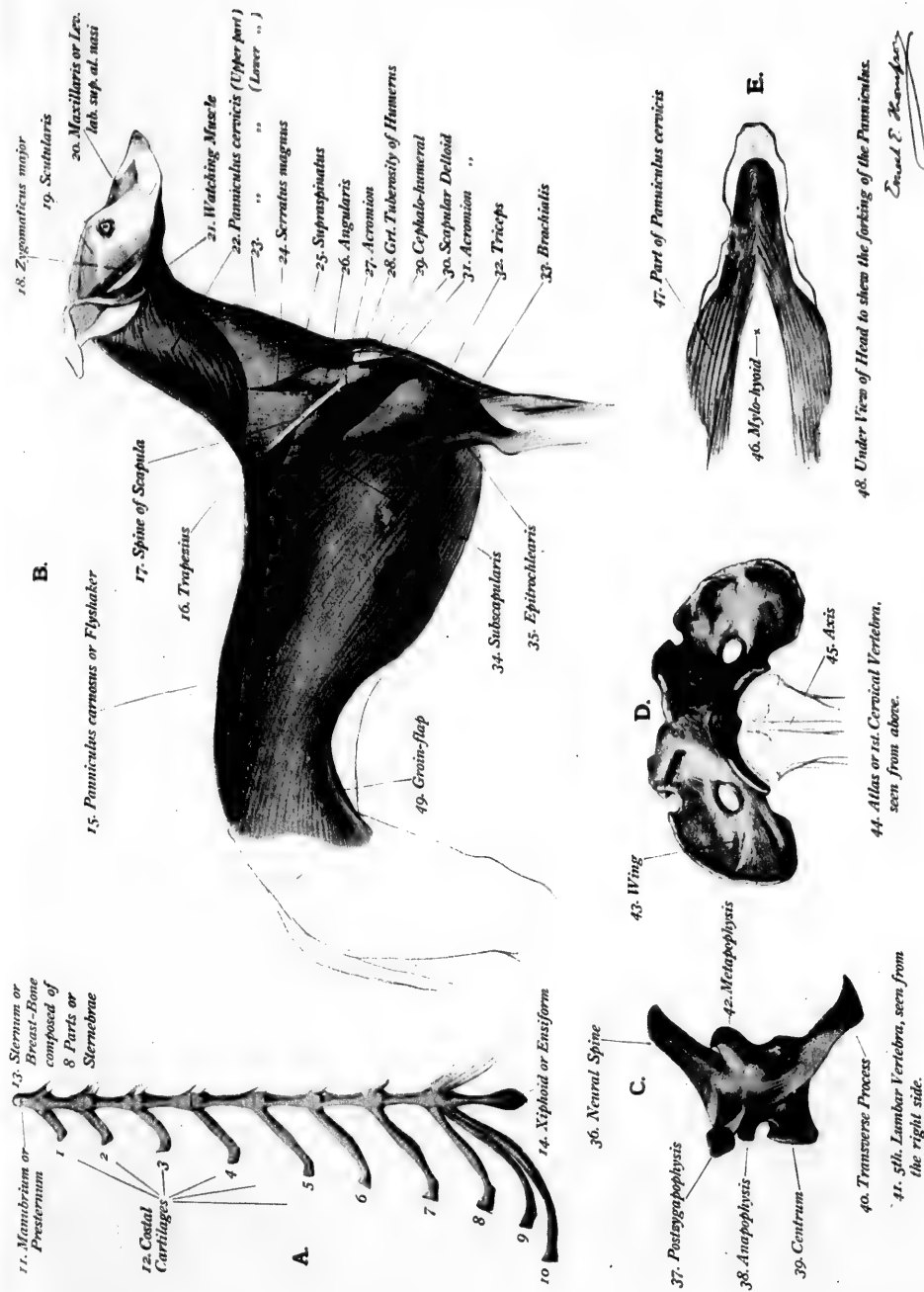


PLATE VII.—THE ANATOMY OF THE GREYHOUND. SOME DETAILS OF THE BONES AND THE FIRST LAYER OF MUSCLES.

A. Sternum seen from below, showing the manner of attachment of the Costal Cartilages.

B. Trunk, with Skin only removed, showing the superficial layer of Muscles.

C. 5th. Lumbar Vertebra, seen from the right side.

D. Atlas or 1st. Cervical Vertebra, with outline of the Axis or Second to show their relations.

E. Under view of Head, to show the forking of the Panniculus.

1. Scapularis
2. Zygomaticus

14. Cephalo-humeral

28. Upper Trapezius

77. Long Tensor
78. Short

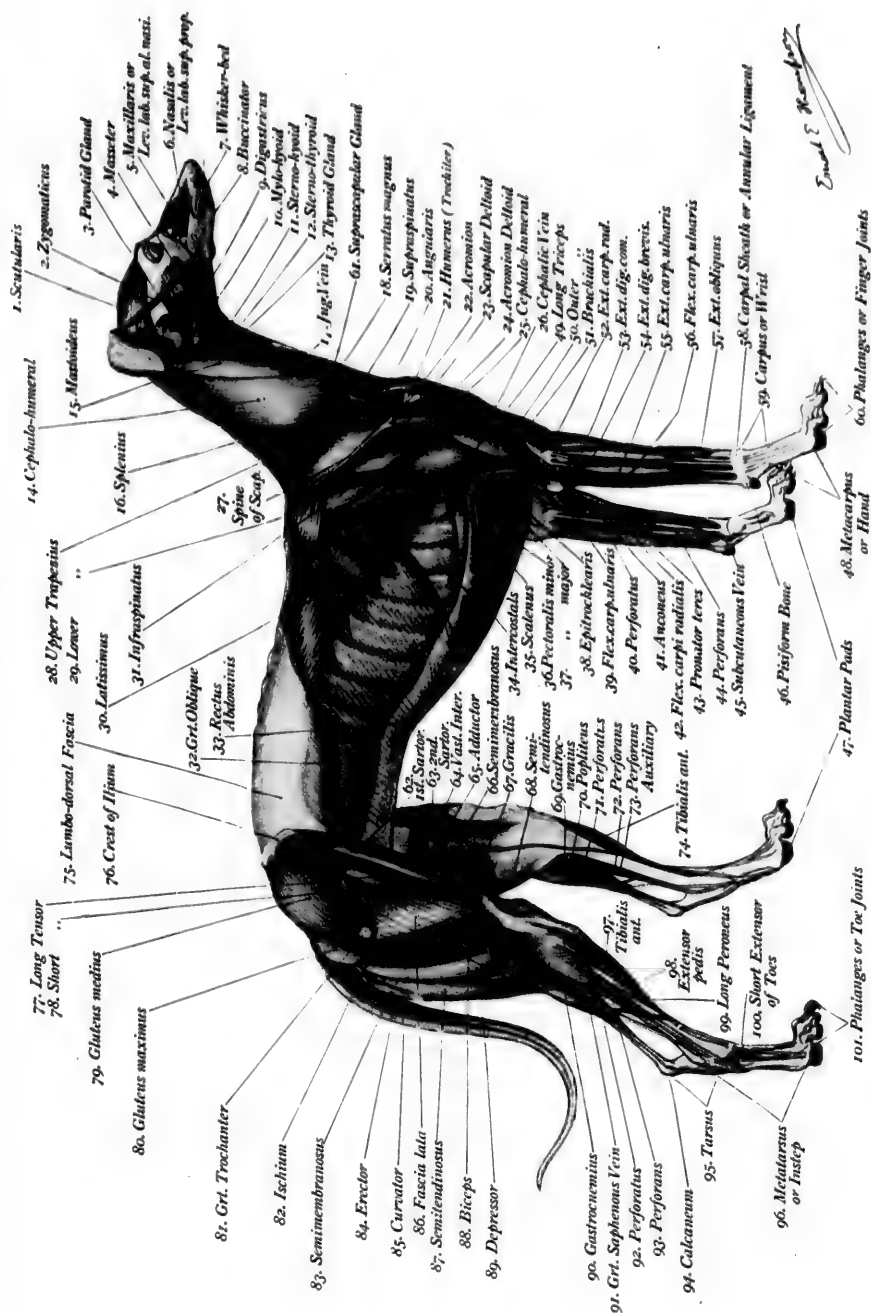


PLATE VIII.—THE ANATOMY OF THE GREYHOUND. THE IMPORTANT MUSCLES.

The Skin and the Skin Muscles or Panniculi are removed, to expose the second or most important layer of Muscles. This plate more than any other is explanatory of the Visible Form.

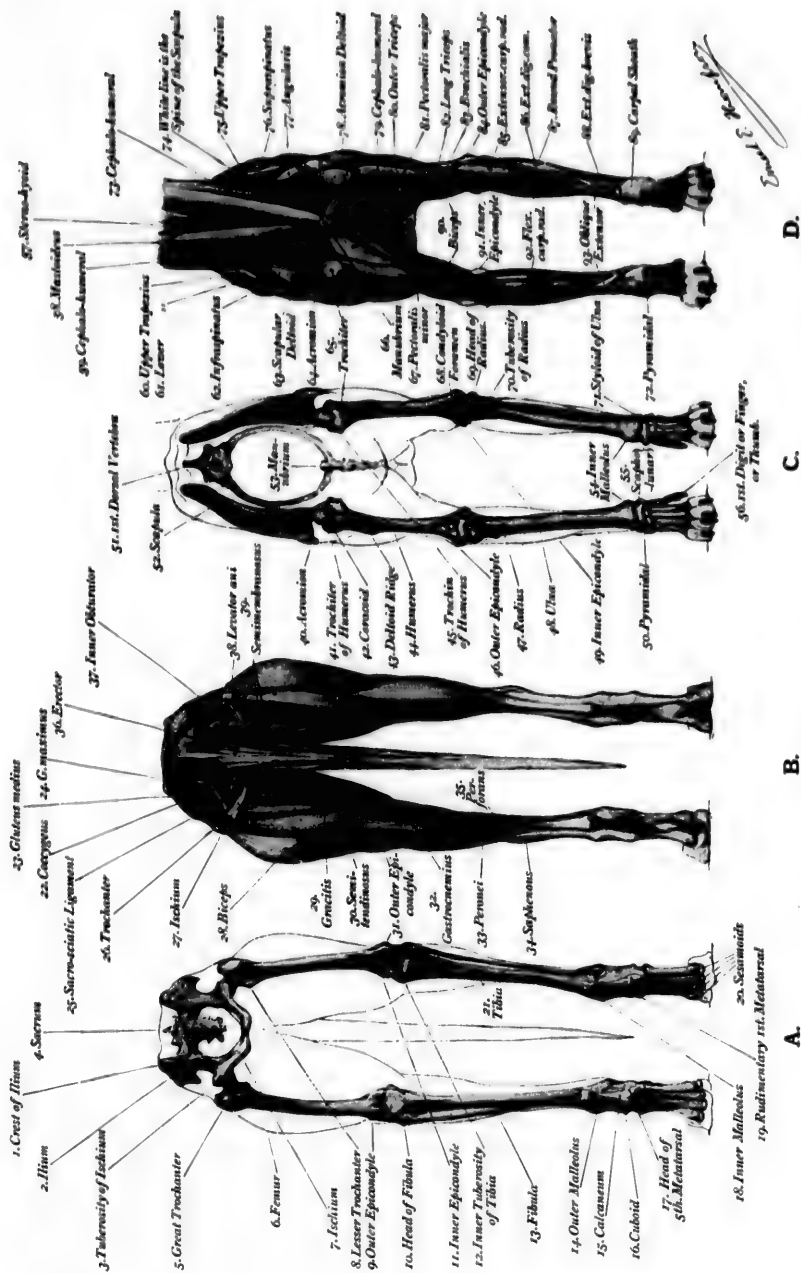


PLATE IX.—THE ANATOMY OF THE GREYHOUND. BACK AND FRONT VIEWS OF THE SKELETON AND THE IMPORTANT MUSCLES.

- A. The Skeleton seen from behind.
 B. The first layer of Muscles in the same region.
 C. The Skeleton seen from in front.
 D. The second layer of important Muscles in the same region.

This Plate corresponds with Plate VIII.

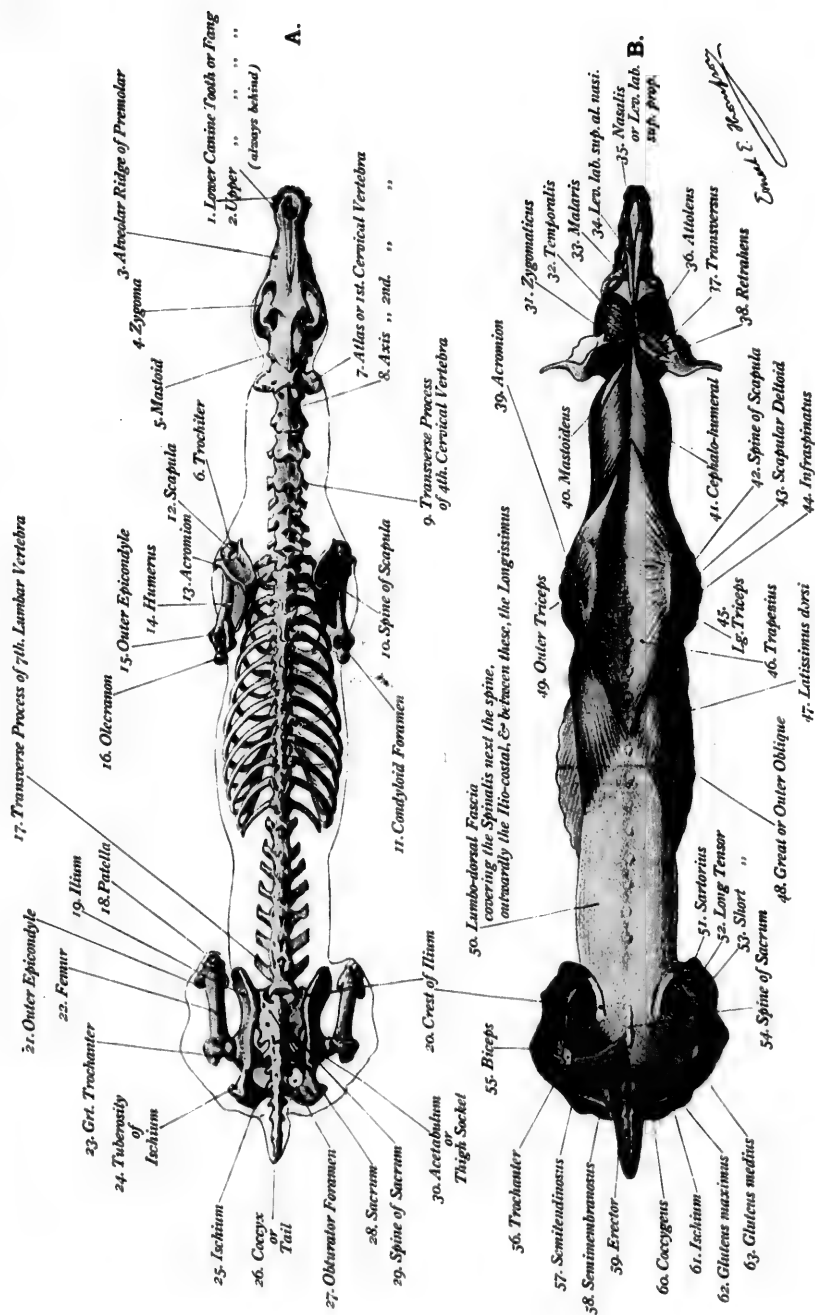


PLATE X.—THE ANATOMY OF THE GREYHOUND. THE SKELETON AND IMPORTANT MUSCLES SEEN FROM ABOVE.
A. SKELETON. The lower part of each Limb is omitted for the sake of simplicity.
B. MUSCLES. The Panniculi and the superficial Muscles of the Cranium are removed.

14. Parietal Bone

6. Semilunar or

1. Inferior Orbital Foramen

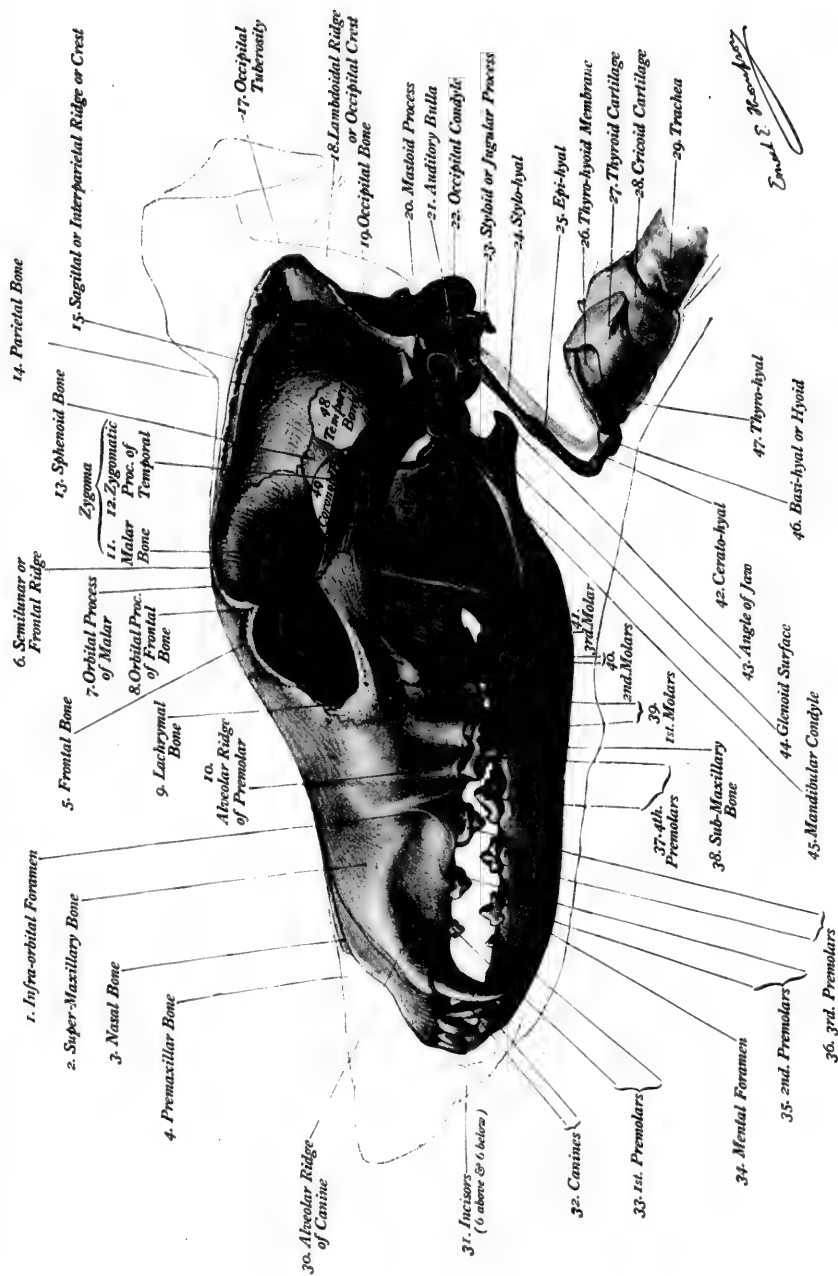
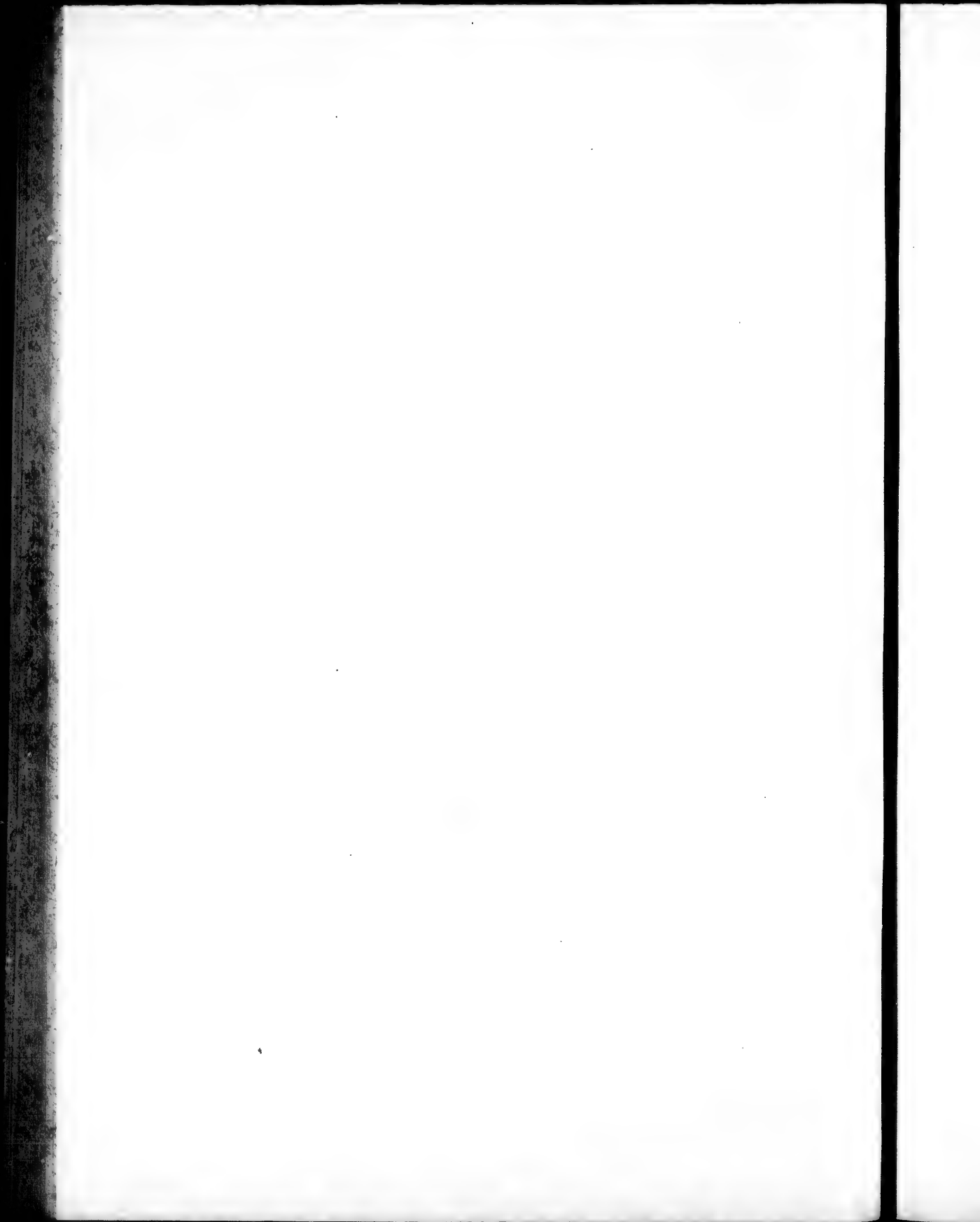


PLATE XI.—THE ANATOMY OF THE GREYHOUND. THE SKULL, SHOWING ALSO THE HYOID BONES AND THE LARYNX.

For the sake of clearness, the far side of the under Mandible is omitted.



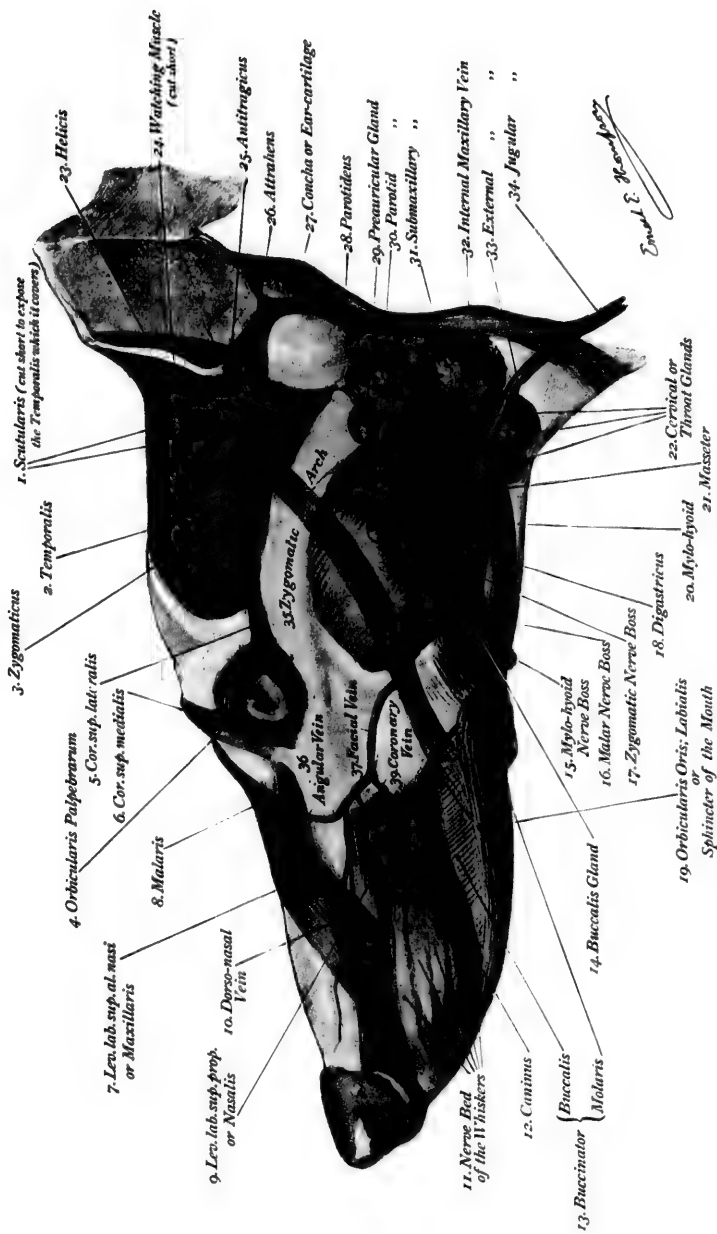


PLATE XII.—THE ANATOMY OF THE GREYHOUND. THE MUSCLES, &c., OF THE HEAD.

The Panniculi have been removed.

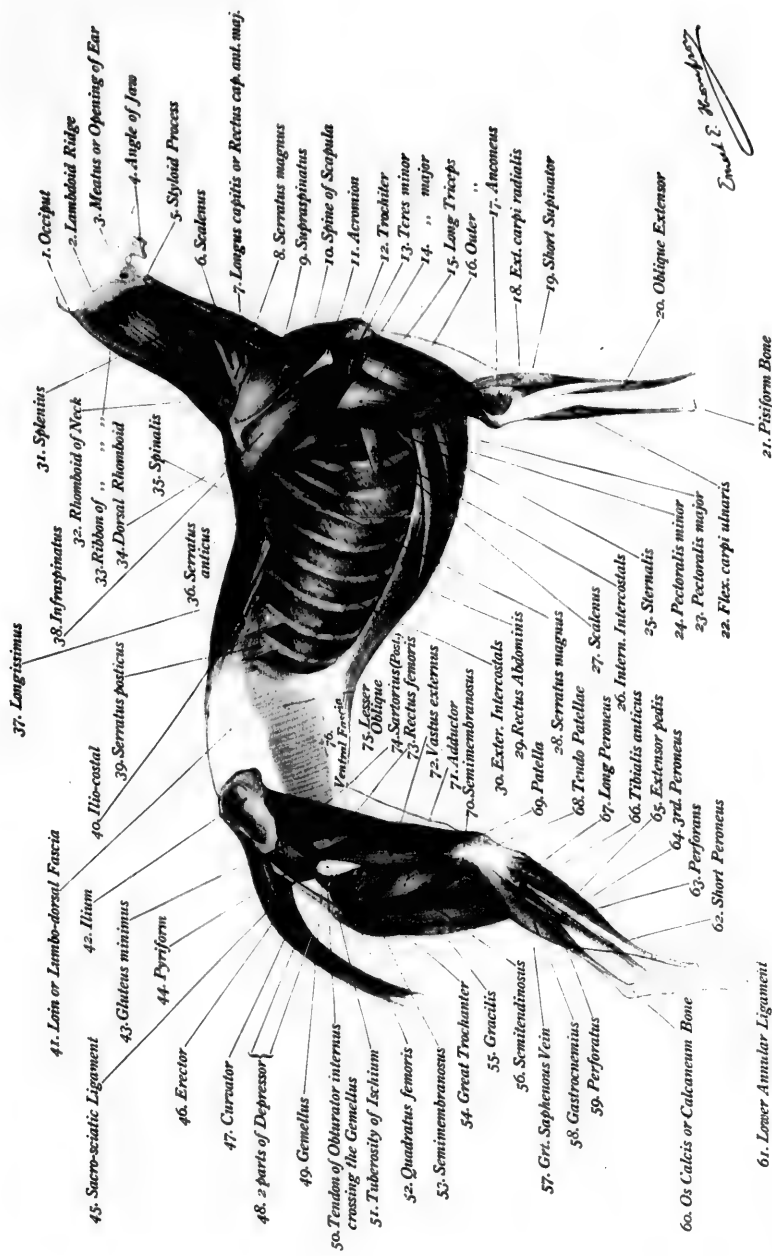


PLATE XIII.—THE ANATOMY OF THE GREYHOUND. THE MUSCLES OF THE THIRD LAYER.

Or the Muscles exposed after removing from the subject as seen in Plate VIII. the Mastoideus, Cephalo-humeral, Sternal-hyoid, Sternal-thyroid, Trapezus, Deltoid, Latissimus, Epitrochlear, Brachialis, Great Oblique, Ext. con. dig., Ext. dig. flexus, Ext. carpi ulnaris, Gluteus maximus, G. medius, First Serratus, Tensor Vaginas, Biceps Femoris, Long Peroneus and Inner Adductor of Tail. The Head, Feet, Further Limbs, Trachea, Glands of Throat and Neck, and the Muscles of the Arms, are omitted for the sake of simplicity.

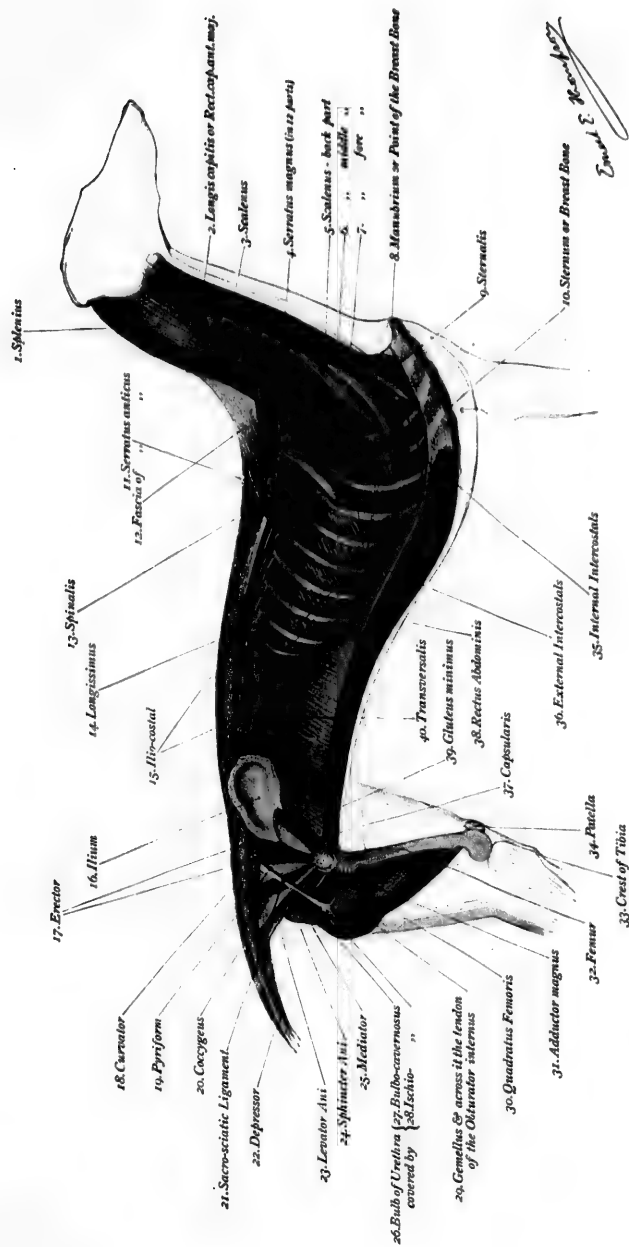
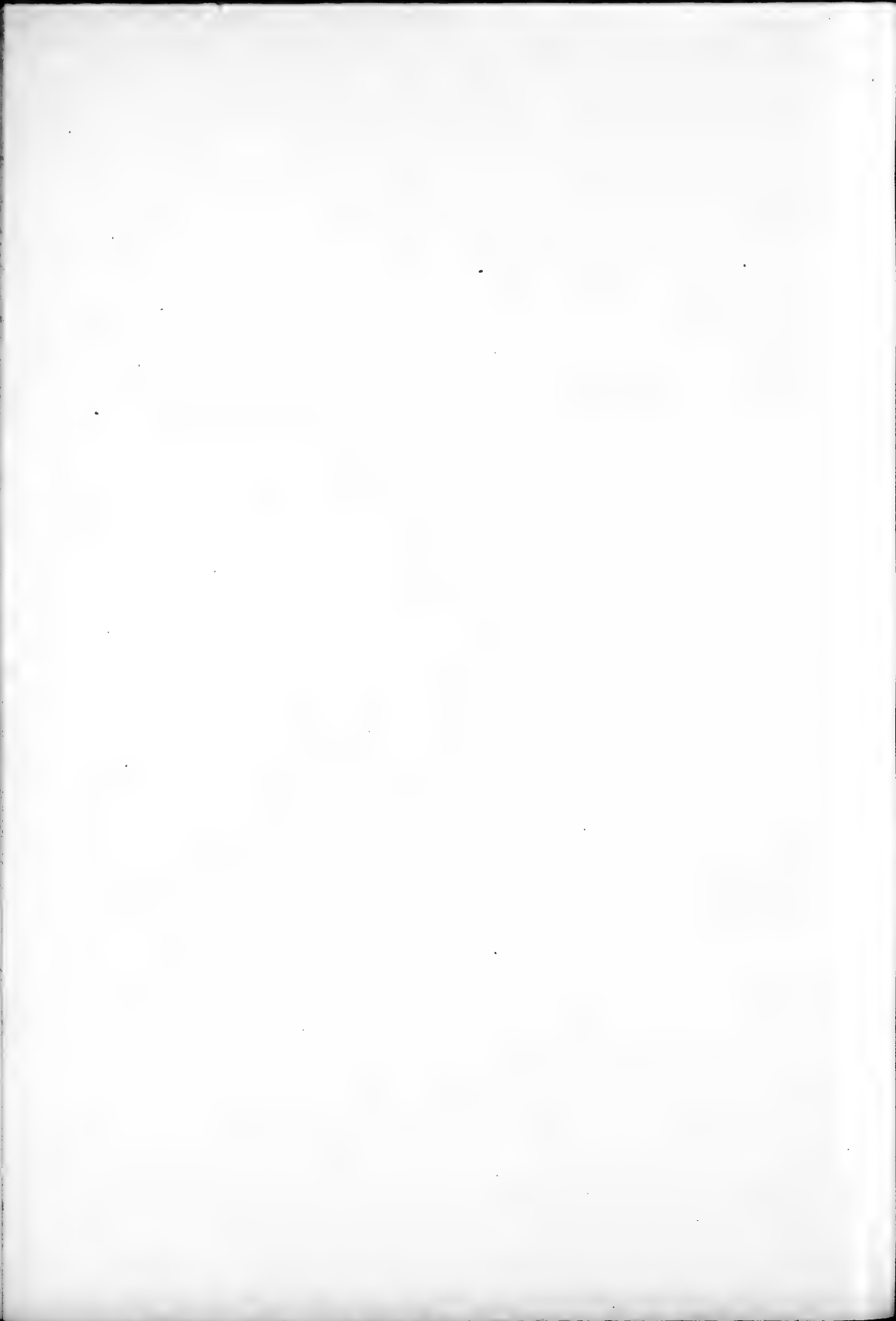


PLATE XIV.—THE ANATOMY OF THE GREYHOUND. THE DEEPER MUSCLES OF THE TRUNK AND THIGH.

The subject is here shown yet farther denuded than in Plate XIII, the following being removed: the whole of the Forelimb, the Rhomboid, Pectoralis, Internal Oblique, the Serratus, Quadriceps, Semitendinosus, Biceps Femoris, Gracilis, and the Muscles of the Lower Leg. In this, however, are shown the Muscles of the Anal region, which were omitted in Plate XIII, in order to simplify that diagram.



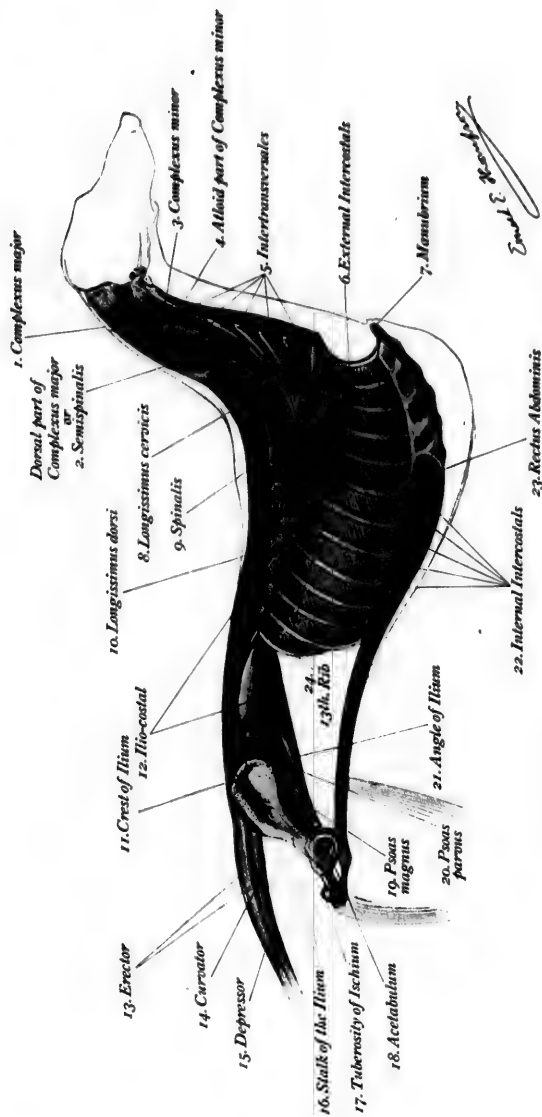


PLATE XV.—THE ANATOMY OF THE GREYHOUND. THE DEEPEST MUSCLES OF THE TRUNK.

The subject of Plate XIV., further dissected by the removal of the Splenius, Three Serrati, Scalenus, Rectus cap. ant. maj., Sternalis, Transversalis, Pyiform, Gluteus minimus, Capulatus, Coccygeus, Quadratus Femoris, Adductor magnus, Pectenus, the Two Obturators, the Sacro-scapular Ligaments, the Anal Muscles, and the Penis.

1. *Teres major*



2. *Subscapularis*



23. *Symphysis of Lower Jaw*



24. *Mylo-Hyoid*

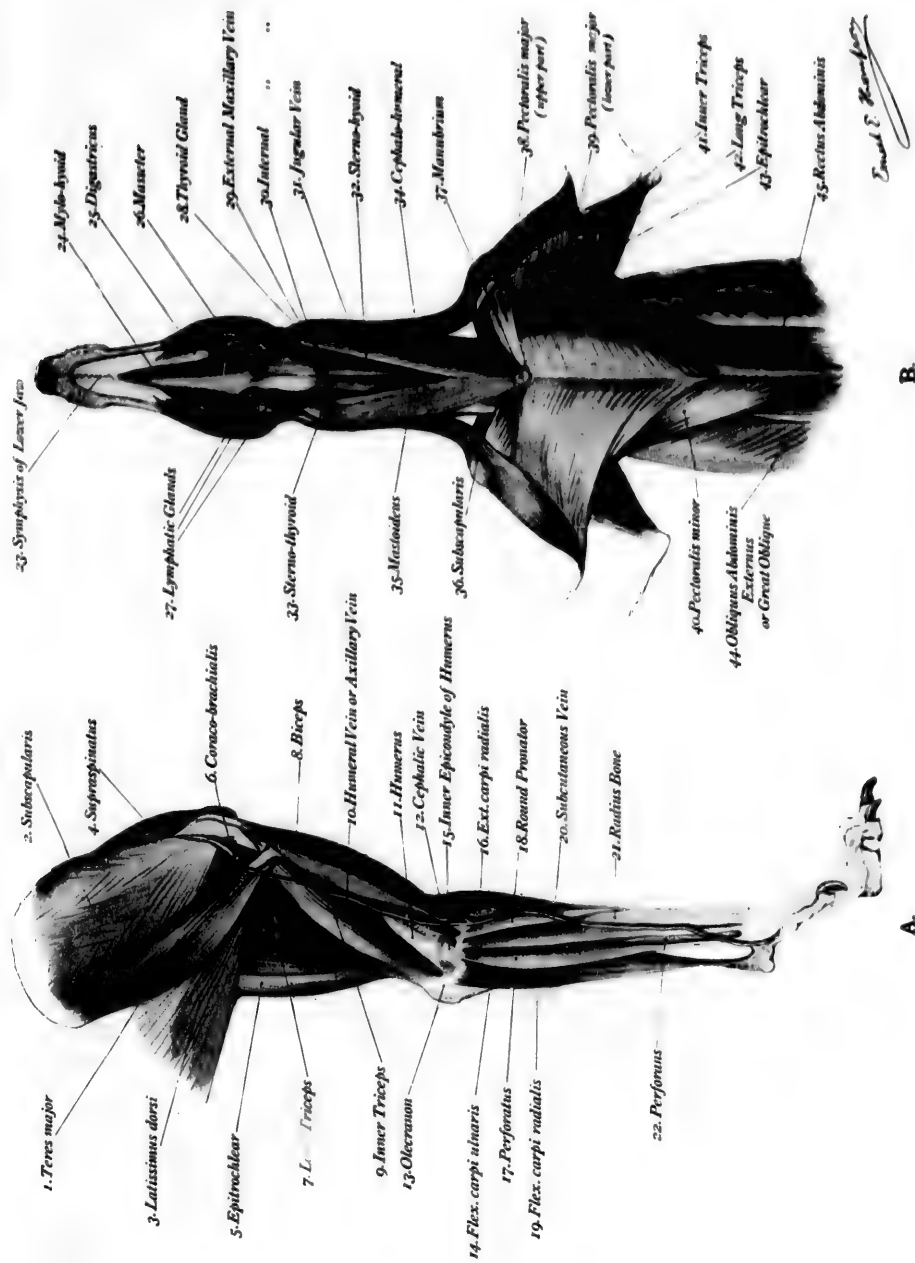


PLATE XVI.—THE ANATOMY OF THE GREYHOUND. INNER SIDE OF FORE-LIMB AND UNDER SIDE OF CHEST.

A. Inner view of left Fore-leg and Shoulder—padding removed except Skin and Tissue.
B. Under view of Neck and Chest, after removing the Panniculus.

A.

H. Cephalo-humeral

B.

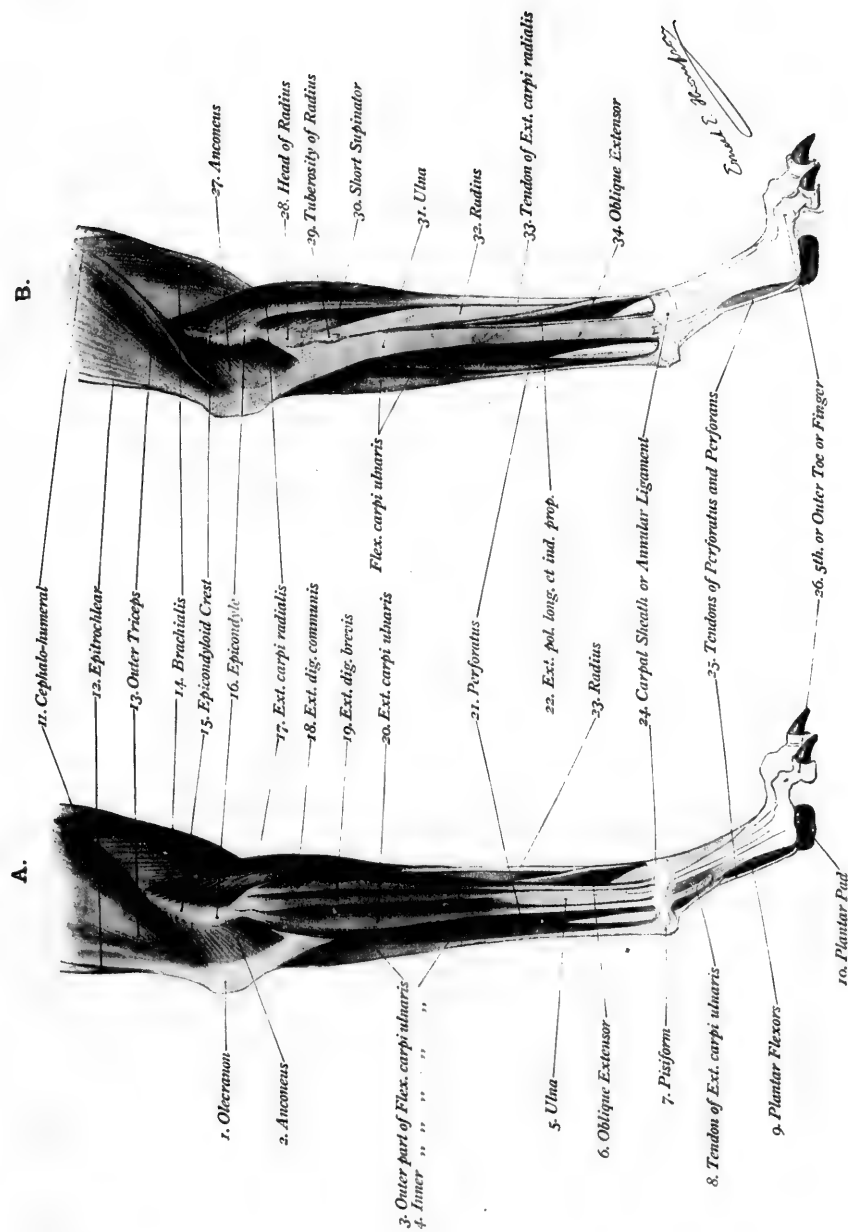


PLATE XVII.—THE ANATOMY OF THE GREYHOUND. EXTERIOR OF FORE-LIMB.
 A. Outer side of right Fore-leg—nothing removed excepting the Skin and the investing Fascia.
 B. Outer side of right Fore-leg, after removing Ext. dig. com., Ext. dig. brevis, Ext. carpi ulnaris.

C

24. Epitrochlear

B.

1. Long Triceps

2. Inner Triceps

A.

A

3. Ulna

B.

21. Ext. carpi radialis

C

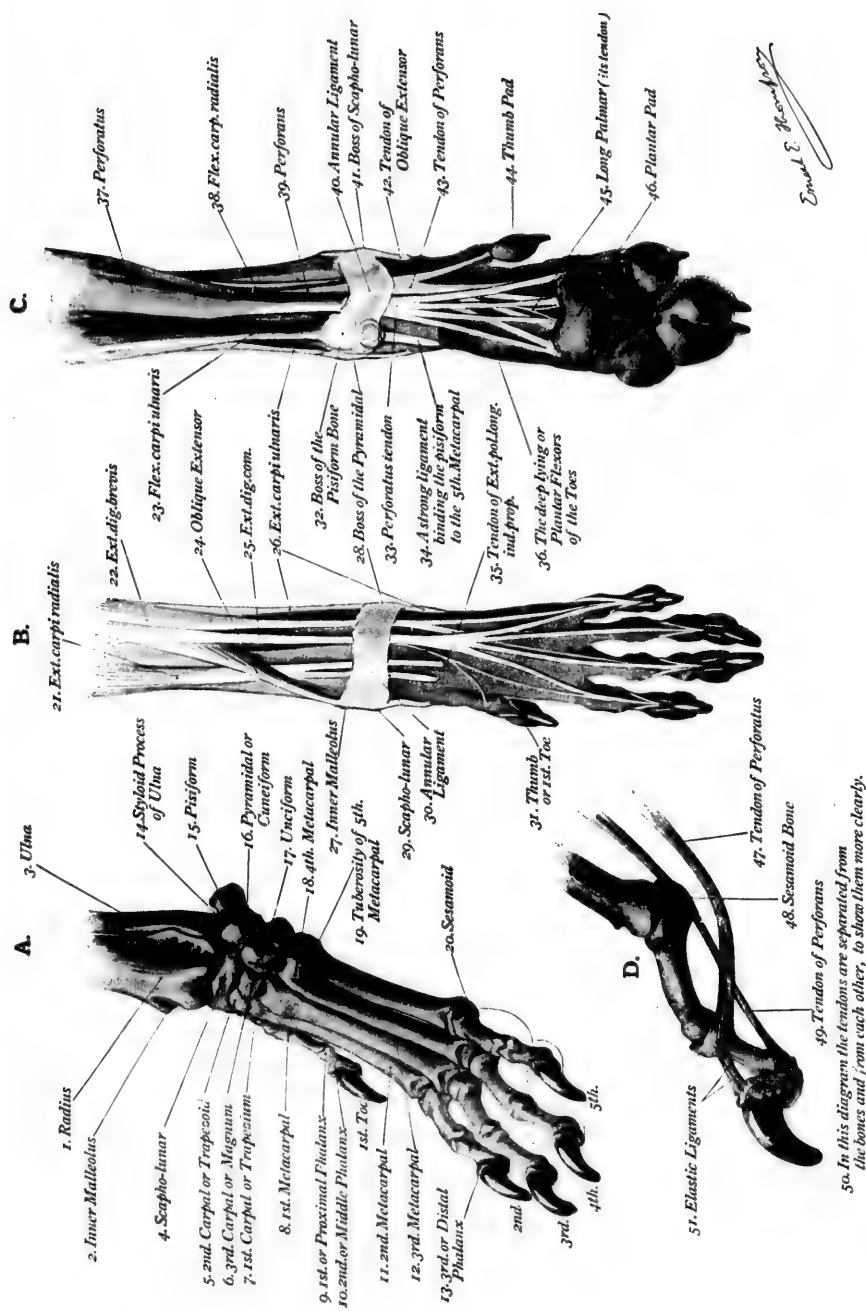


PLATE XIX.—THE ANATOMY OF THE GREYHOUND. THE BONES AND MUSCLES OF THE LEFT FORE-FOOT.

- A. The Bones of the Paw seen from the outer side in front.
B. The Paw seen from above, with Skin and Fascia only removed.
C. The same from behind or below.
D. The Bones and mechanism of a toe, showing the reasons for the names Perforatus (or perforated) and Perforans (or performing).

A.



1. Crest of Ilium

B.



C.



37. Auricular Surface
of Ilium

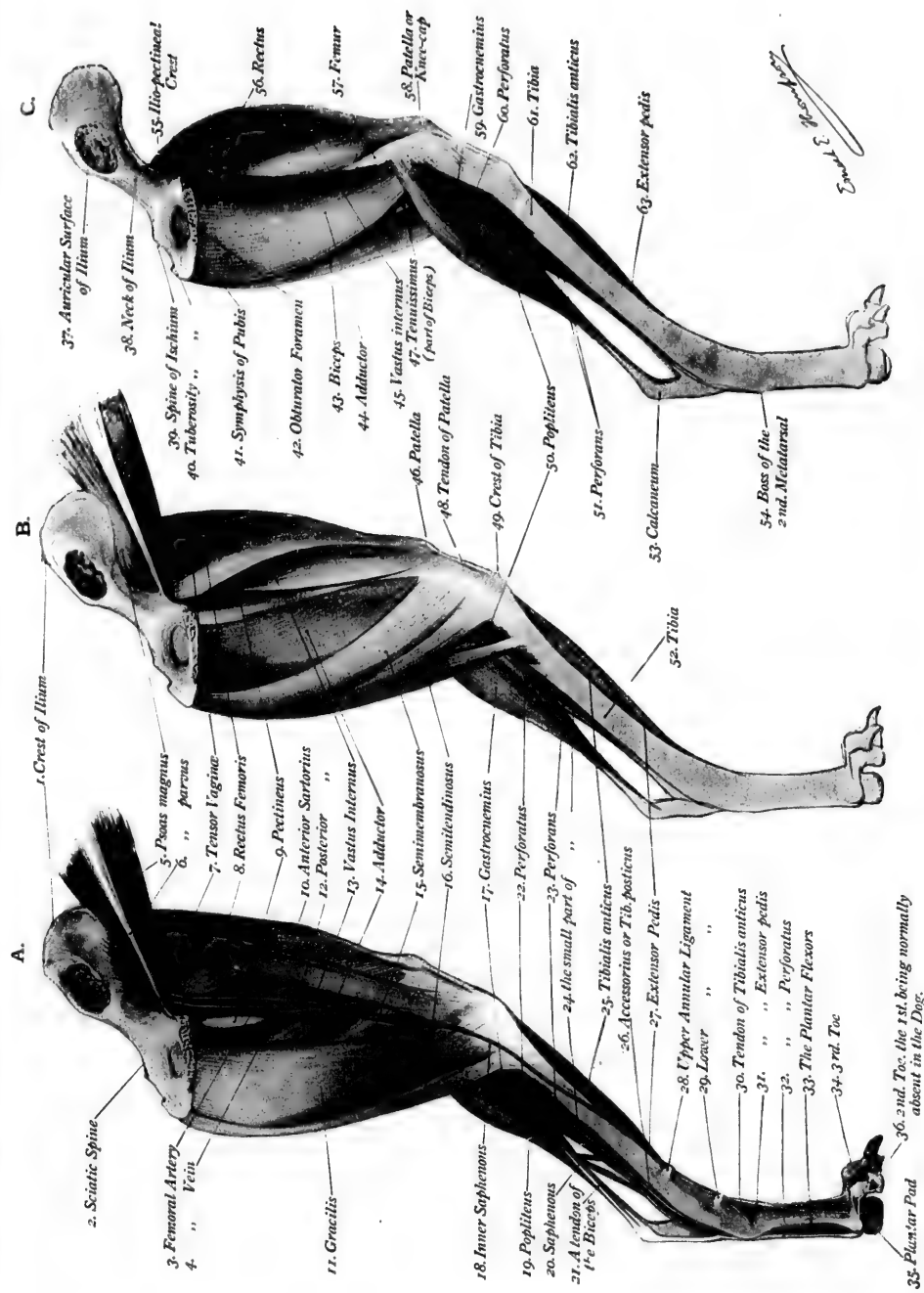


PLATE XX.—THE ANATOMY OF THE GREYHOUND. INNER SIDE OF LEFT HIND-LEG.

A. The Limb with Skin and Fascia only removed.
 B. The same after removing also the external Blood-vessels, the Gracilis, the Tibialis posterior, and the Sartorius.
 C. The same after removing also the Iliopectineus, Tensor Vaginis, Semitendinosus, and Pectineus.

39. *Tendon of Gastrocnemius*
C.

22. *Tibialis anticus*
B.

A. 3. *Fibula*

1. *Tibia*

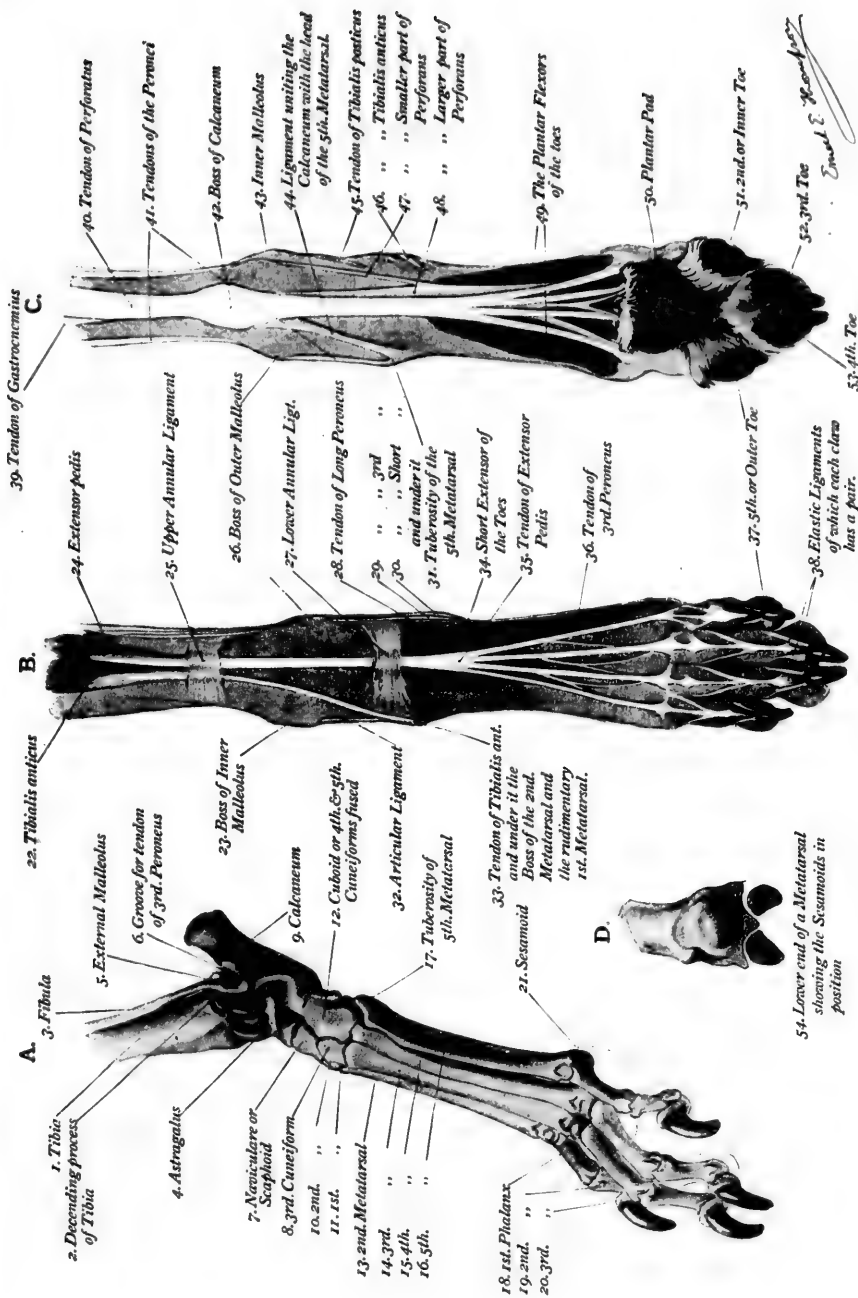


PLATE XXI.—THE ANATOMY OF THE GREYHOUND. THE BONES AND MUSCLES OF THE LEFT HIND-FOOT.

A. The Bones of the Foot seen from the outside in front.
B. The Bones of the Foot seen from the inside in front.
C. The same from behind or below.
D. A pair of Sesamoids, showing how they form the groove for the Tendons under each Metatarsal.



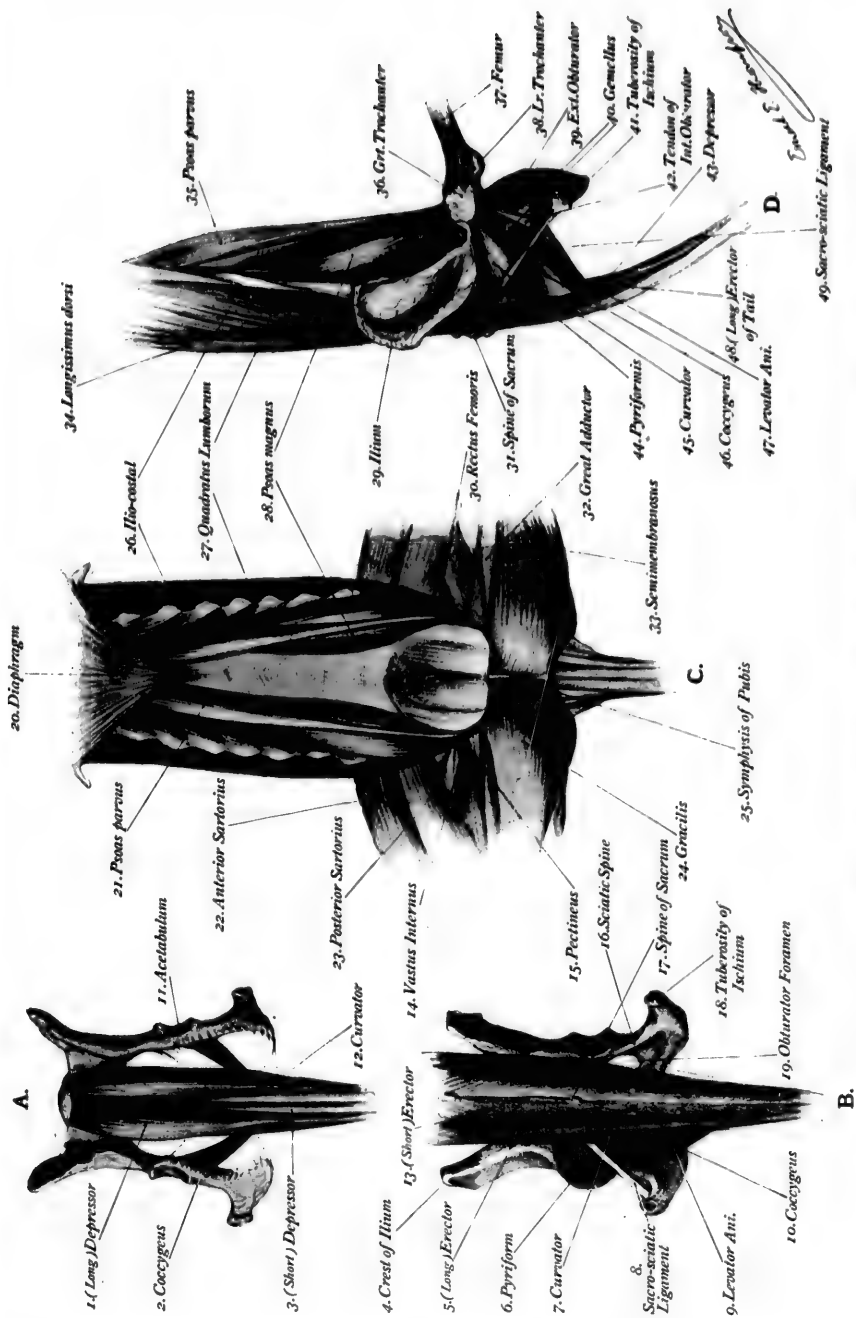


PLATE XXII.—THE ANATOMY OF THE GREYHOUND. THE BONES AND MUSCLES OF THE PELVIS AND TAIL.

A. Under view of Pelvis, with Pubic Bones cut away to show the attachment of the Muscles of the under side of the Tail.
 B. Pelvis seen from above, with the Gluteal Muscles, &c., removed.
 C. Under view of Pelvic region, with Abdominal Walls and Muscles removed.
 D. Side view of Pelvic region, with Abdominal Walls and Gluteal Muscles removed.



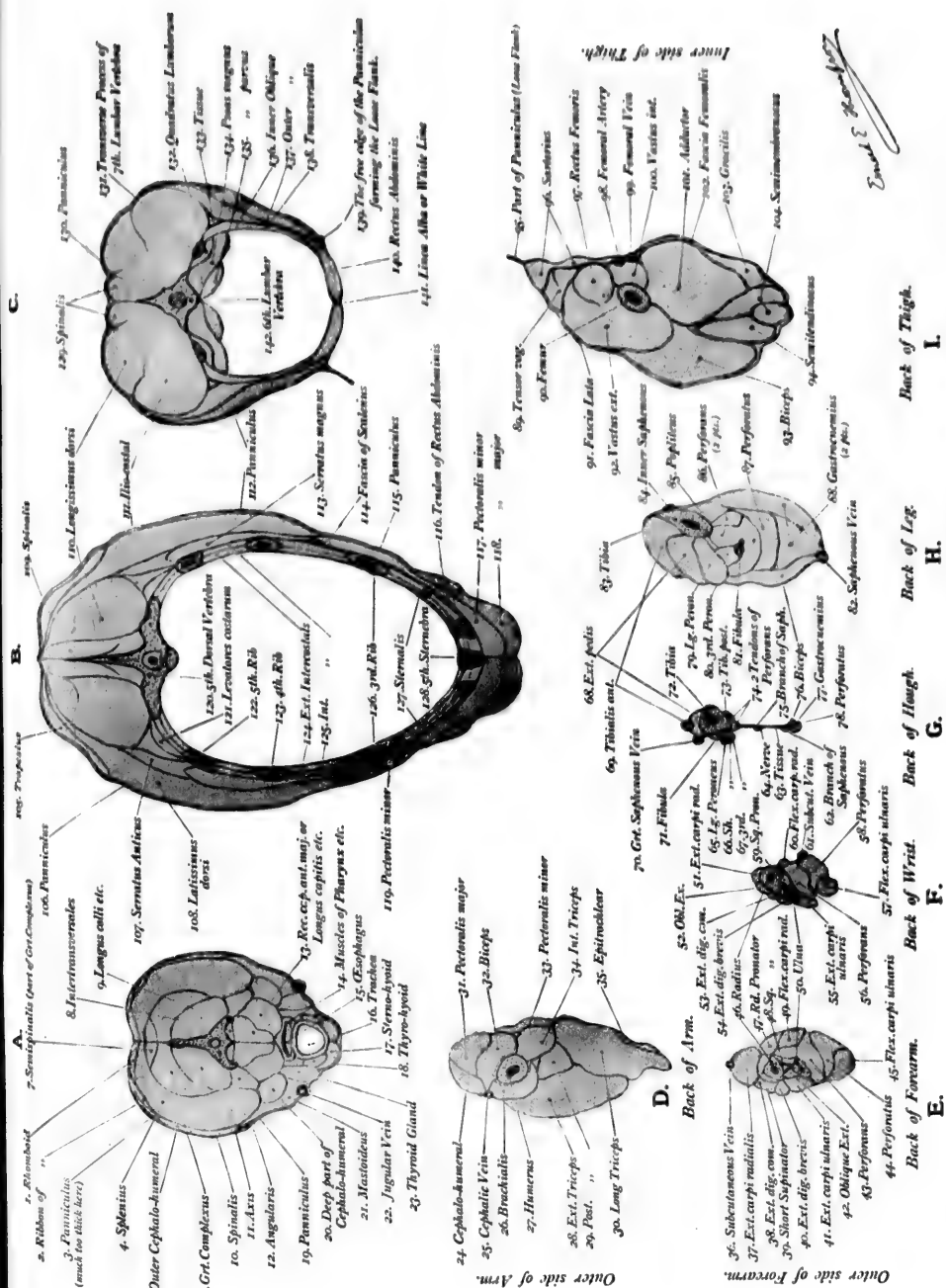


PLATE XXIII.—THE ANATOMY OF THE GREYHOUND. SECTIONS OF TRUNK AND LIMBS.

The sections here shown were made by sawing up a hard-frozen Greyhound. In each case the natural front and the natural top are shown uppermost, and in the case of the leg sections the outer side is always at the left of the diagram. The sections are all on exactly the same scale, that is one-third of life size, and are made at right angles to the principal bone. In all cases the Skin is omitted and in many the name of a Muscle is written when of course its Source is understood.

A. Through the Axis or Second Cervical Vertebra. B. Through the lower Fore-arm or Wrist, just above the lowest quarter. C. Through the middle of the Thigh, just below the lowest quarter. D. Through the middle of the Thigh, just above the lowest quarter. E. Through the middle of the Thigh, just below the lowest quarter. F. Through the middle of the Thigh, just above the lowest quarter. G. Through the middle of the Thigh, just below the lowest quarter. H. Through the middle of the Thigh, just above the lowest quarter.

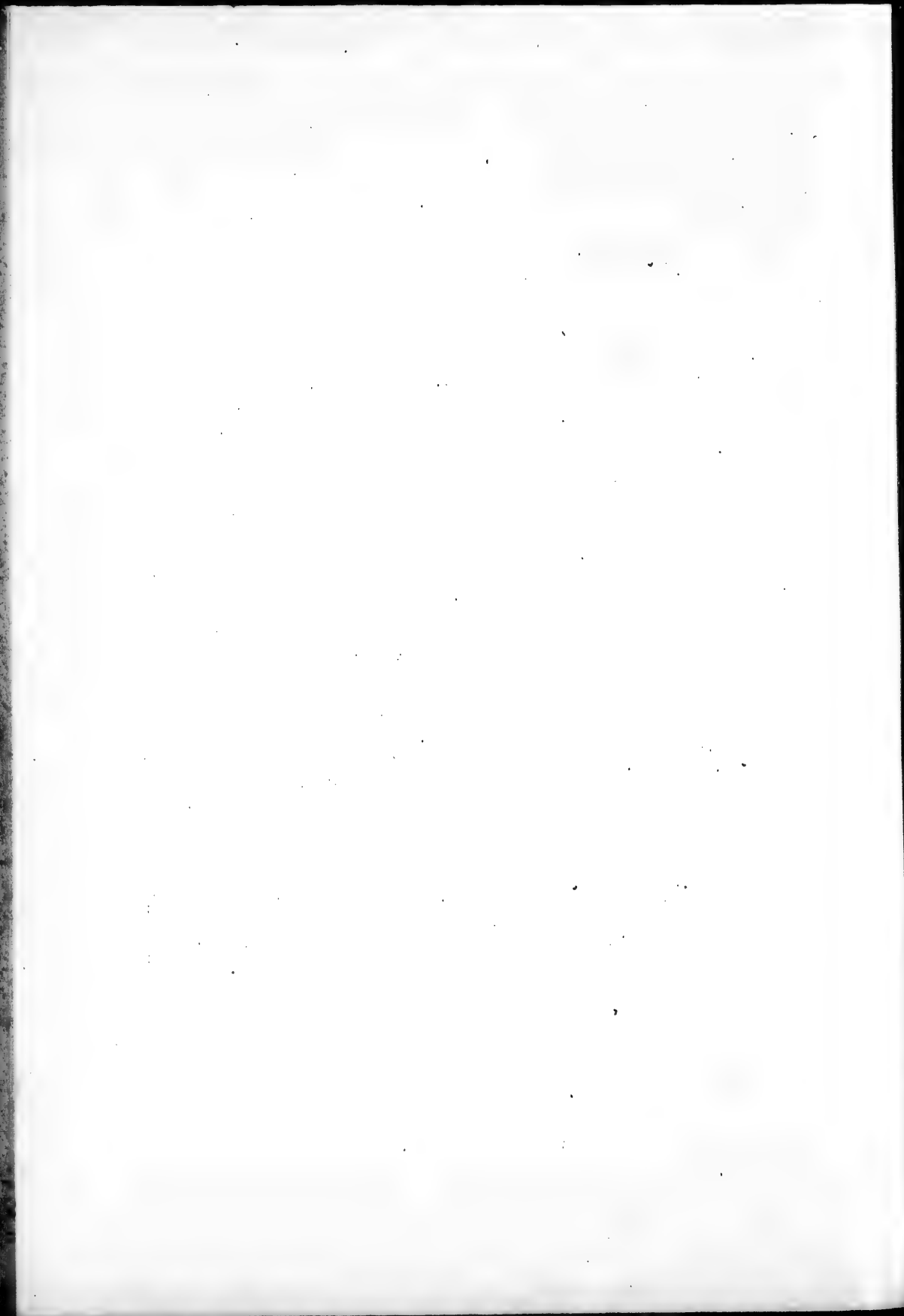


1. The thin Auricular Skeel cut short
to show the important muscles

29. Cephalo-humeral

66. Lumbo-dorsal Fascia covering the Ilio-costal,
the Longissimus and the Spinalis





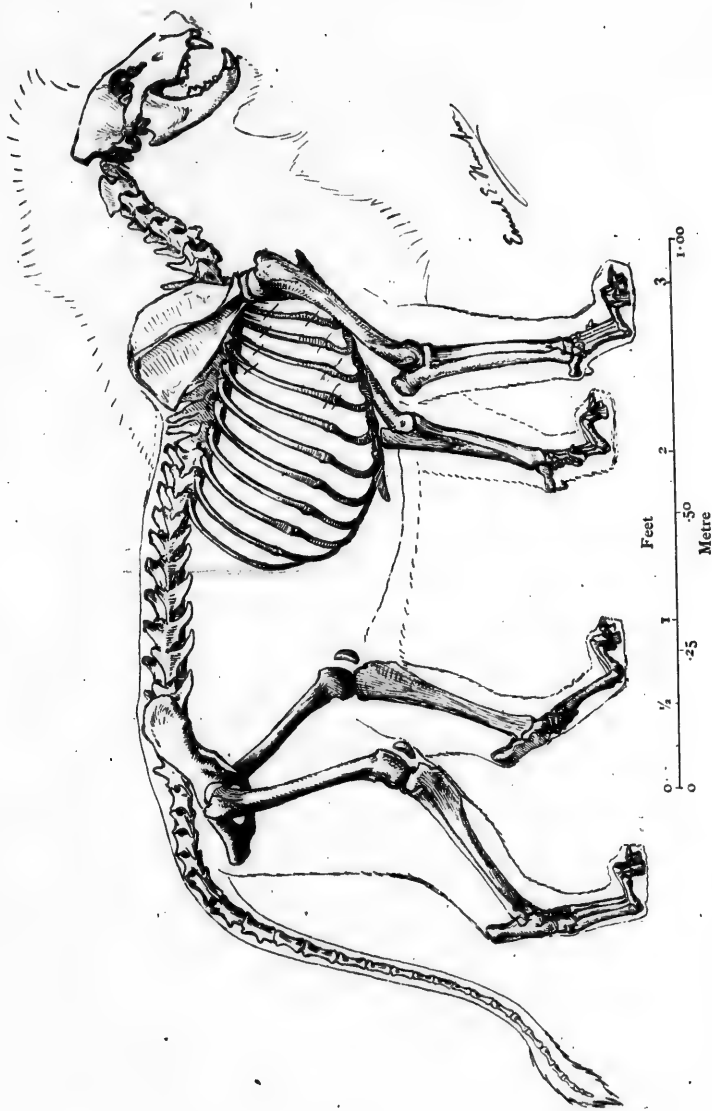


PLATE XXVI.—THE SKELETON OF THE LION (one-eighth of life-size).
The Jaws, the Ribs, and the Scapula of the far side are omitted for the sake of simplicity. For the names of parts see the plates of the Dog's Skeleton.

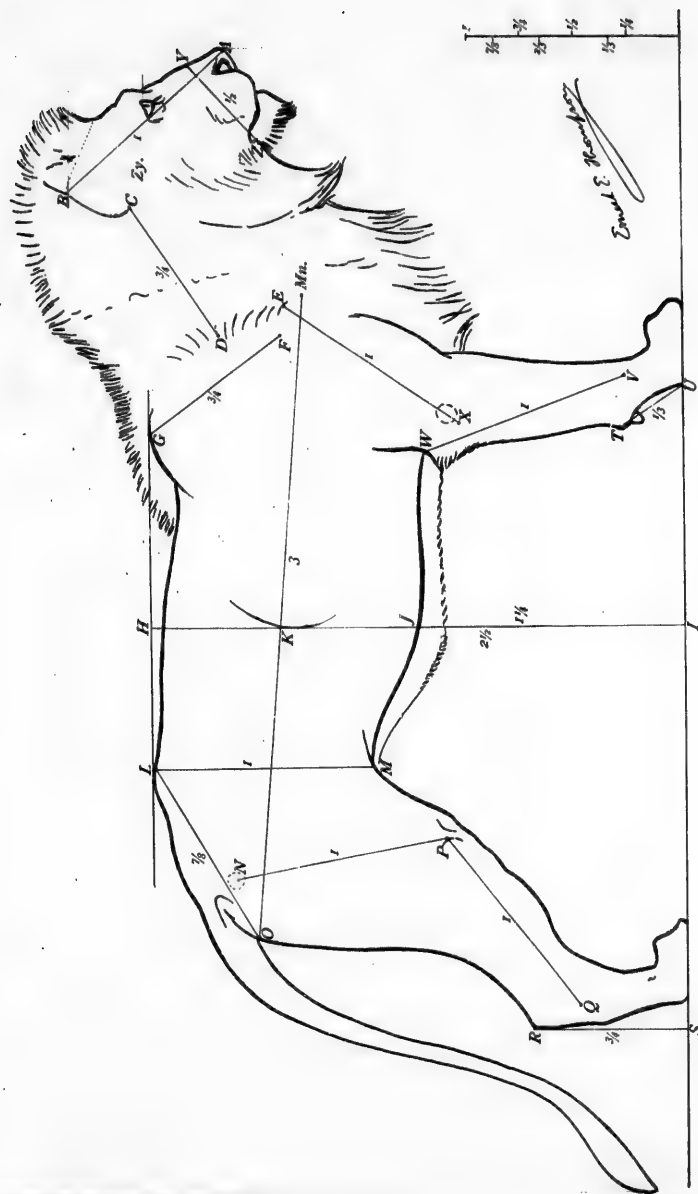
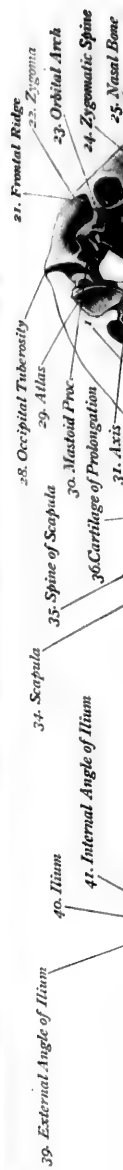


PLATE XXVII.—THE PROPORTIONS OF THE LION.

The Lion is lower and longer than the Dog or Wolf, being 2½ heads high by 3 long. In addition to the proportions indicated on the diagram, the width of the Body through the Acromion = 1 head. The width of the head at the Zygomatic arches, Zy = ½ head. The greatest width through the crest of the line = ½ head. The length of Tail = the height at Shoulder. The Ribs end at K exactly in the middle of the line O, Mu. The height at the Shoulder is more than half the total length from Nose to Ichium. The Loose Skin on the Belly as indicated is very variable.



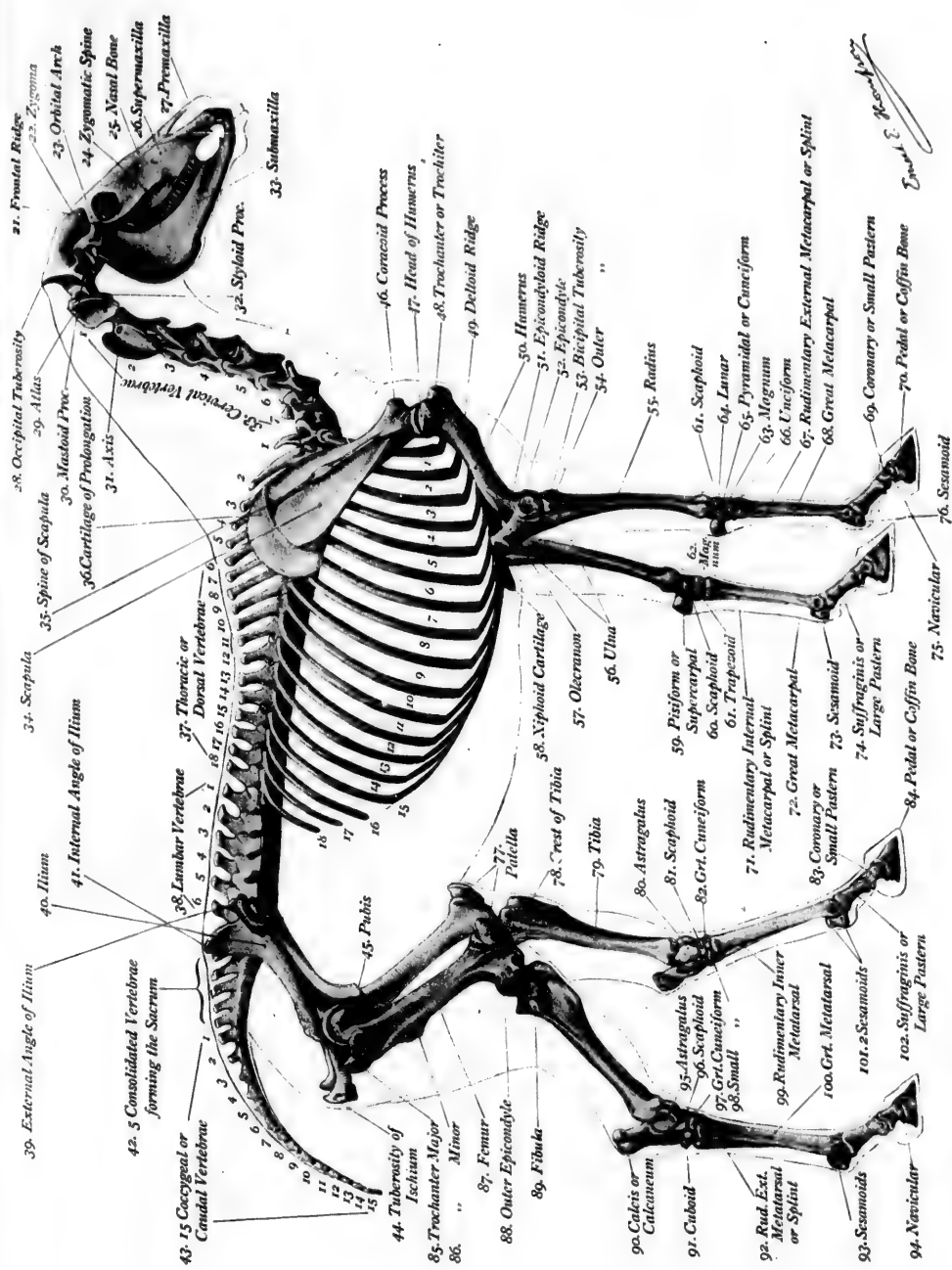


PLATE XXVIII.—THE ANATOMY OF THE HORSE. THE SKELETON.

The Jaws, Ribs, and Scapula of the far side are omitted for the sake of simplicity.

For the nomenclature of parts not herein named see the corresponding plates of the Dog.

Emil E. Knapp

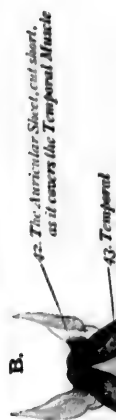
22. Parotid Gland 24. Cephalothorax
 23. Temporal 25. Zygomatic Arch
 26. Rhomboid 27. Parotid Gland
 28. Sphenoid 29. Corrugator
 30. Allis 31. Orbicularis
 32. Alveolar part of

80. Gt. Oblique
 79. Interstitial
 78. Serratus magnus
 77. Latissimus dorsi
 81. Crest of Ilium
 82. Gluteus medius



PLATE XXIX.—THE ANATOMY OF THE HORSE. THE IMPORTANT MUSCLES.

The back part of the Parotid Gland, the Auricular Sheet, and the superficial part of the Cephalo-humeral are removed to expose the more important Muscles. The Facial Vein varies greatly with the individual; in this the simplest form is represented.



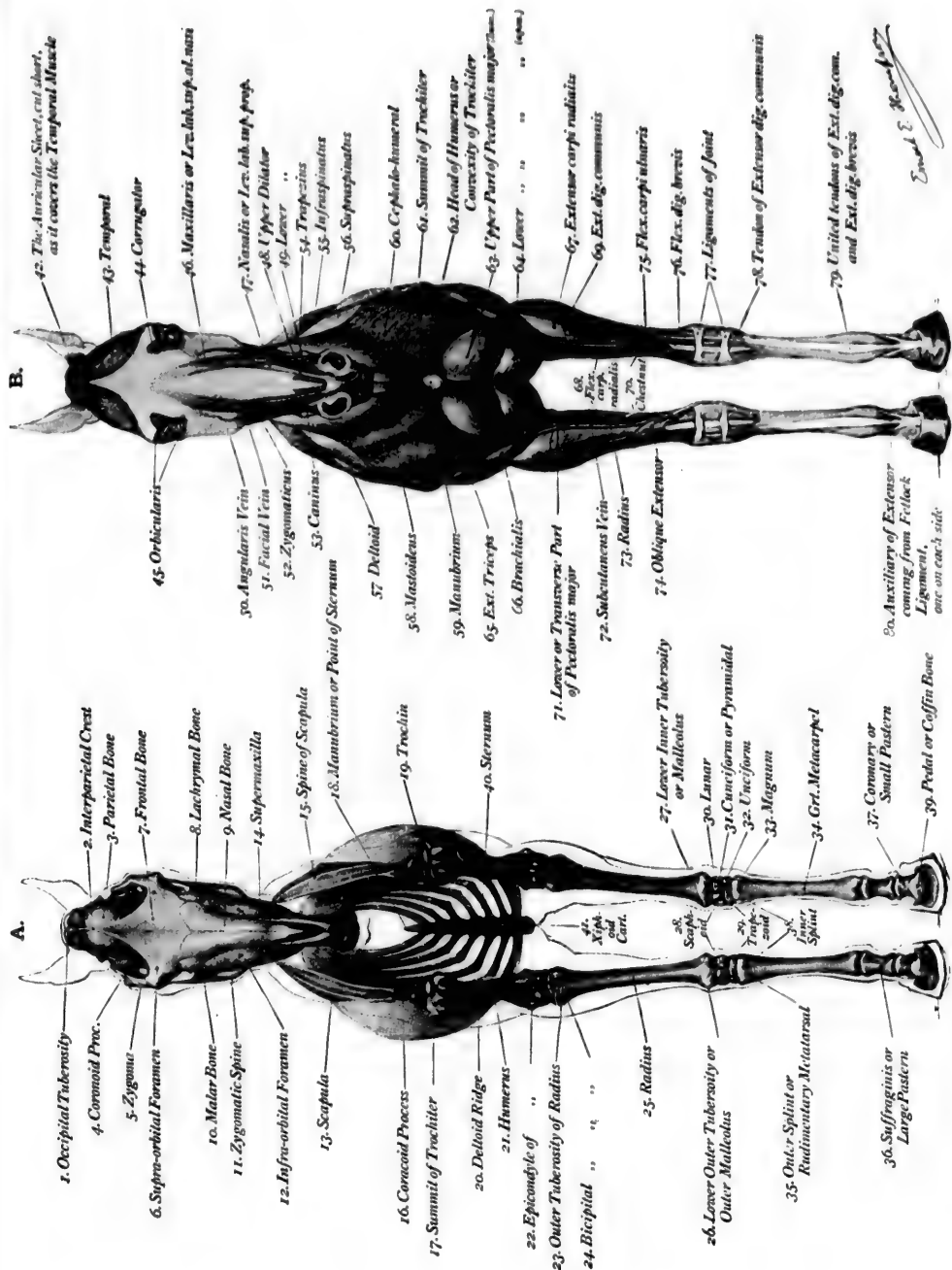


PLATE XXX.—THE ANATOMY OF THE HORSE. FRONT VIEW OF THE SKELETON AND THE IMPORTANT MUSCLES.
 The Auricular Sheet and the Panniculi are removed.

1. Spine of Sacrum
2. Internal Angle of Ilium
3. External
4. Ilium

37. Erector of Tail
38. Middle Gluteus or G. medius

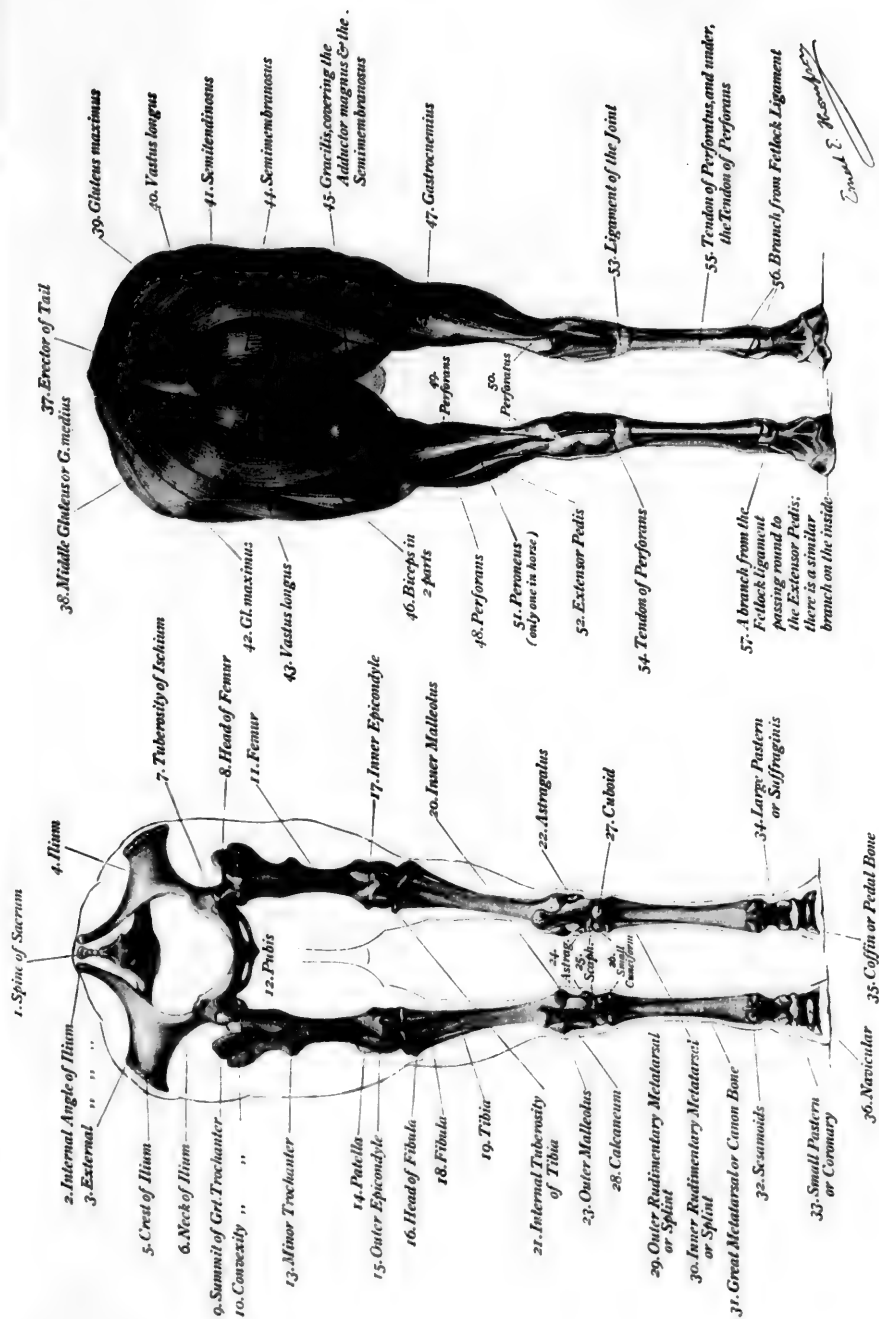


PLATE XXXI.—THE ANATOMY OF THE HORSE. BACK VIEW OF THE SKELETON AND THE IMPORTANT MUSCLES.
The Tail is cut off at the base.

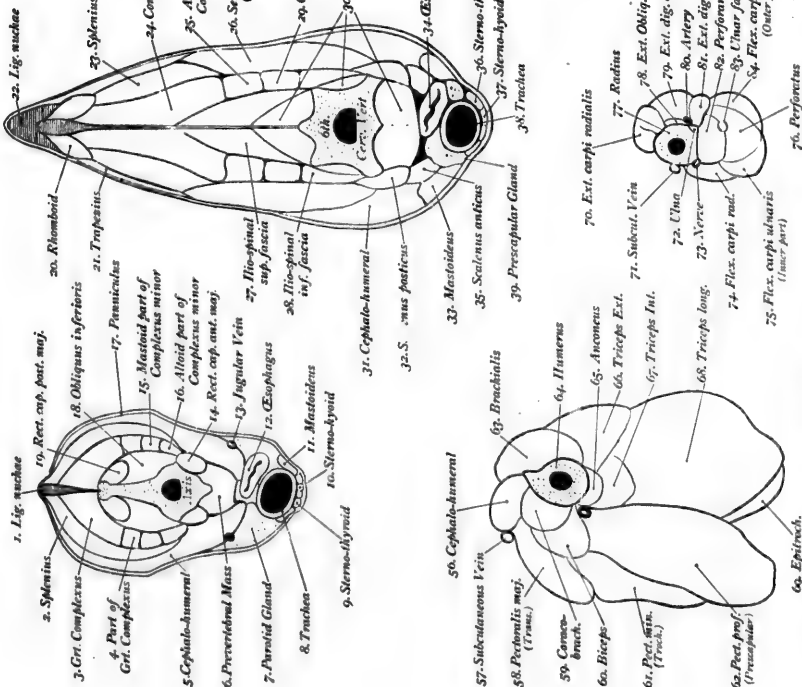
A. Section of Neck at Axis.

B. Section of Neck at 6th. Cerv. Vert.

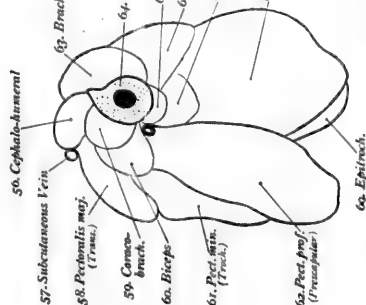
C. Section of Thorax at 7th. Dorsal Vert.



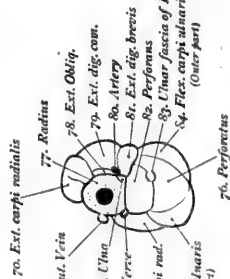
A. Section of Neck at Axis.



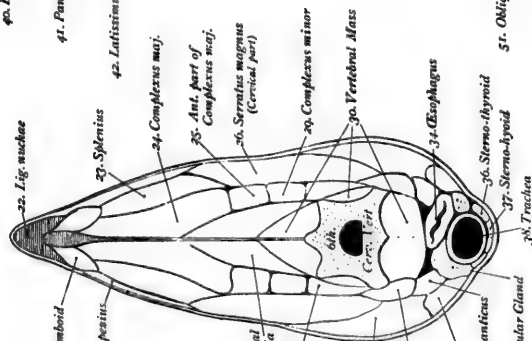
D. Section at middle of Humerus.



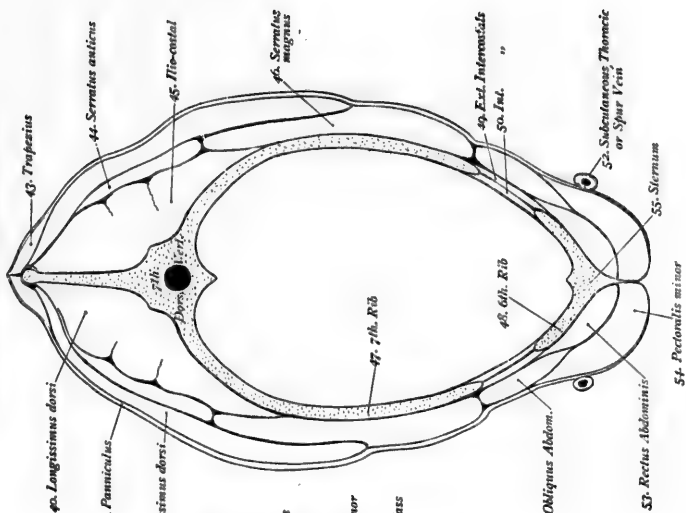
E. Section at middle of Radius.



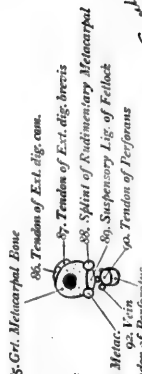
B. Section of Neck at 6th. Cerv. Vert.



C. Section of Thorax at 7th. Dorsal Vert.



F. Section at middle of Metacarpus.



The sections are one-fifth of natural size, are at right angles to the long axis of the part cut, and are distended of Skin and all but the very important Fascia. The upper side is always towards the top of the plate, and the right side to the right. In the case of the Limbs, the right Limb is always shown with the outer side to the right and the fore-side upwards. The lower face of the section is the one drawn.

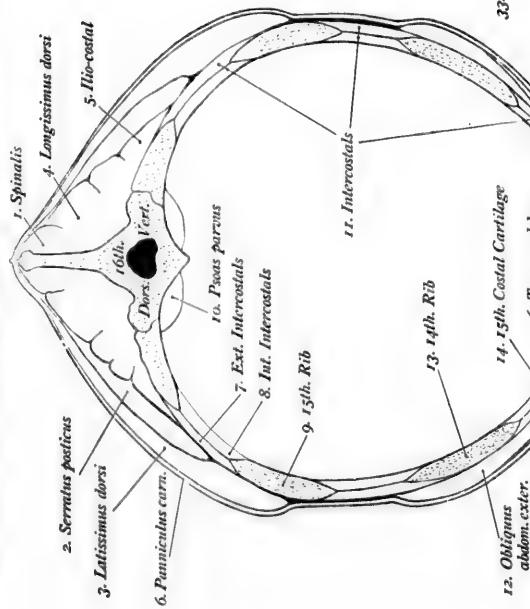
G. Section of the Body at the 16th. Dorsal Vertebra, i.e. the deepest part of the belly.



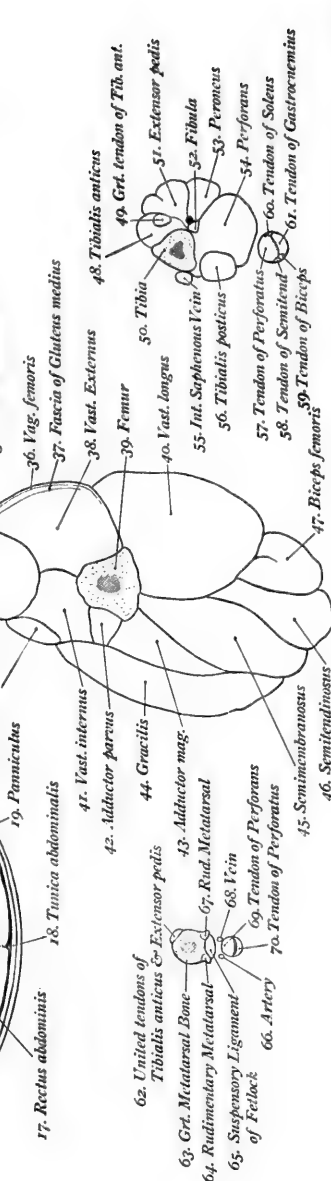
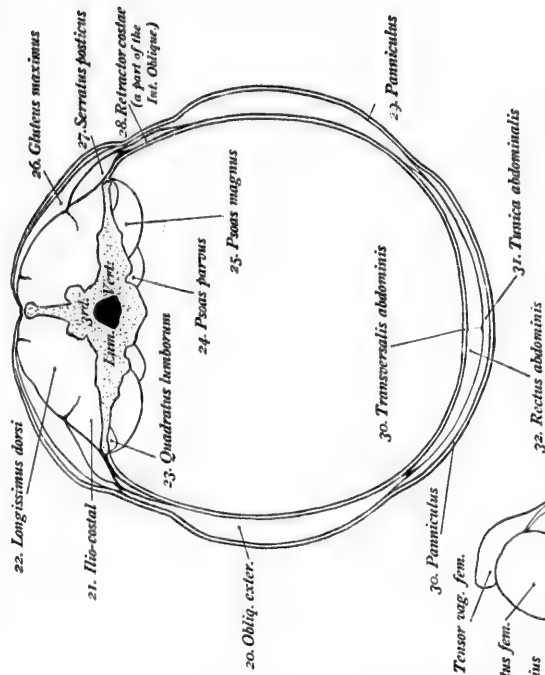
H. Section of the Trunk at the 3rd. Lumbar Vertebra.



G. Section of the Body at the 16th. Dorsal Vertebra, i.e. the deepest part of the belly.



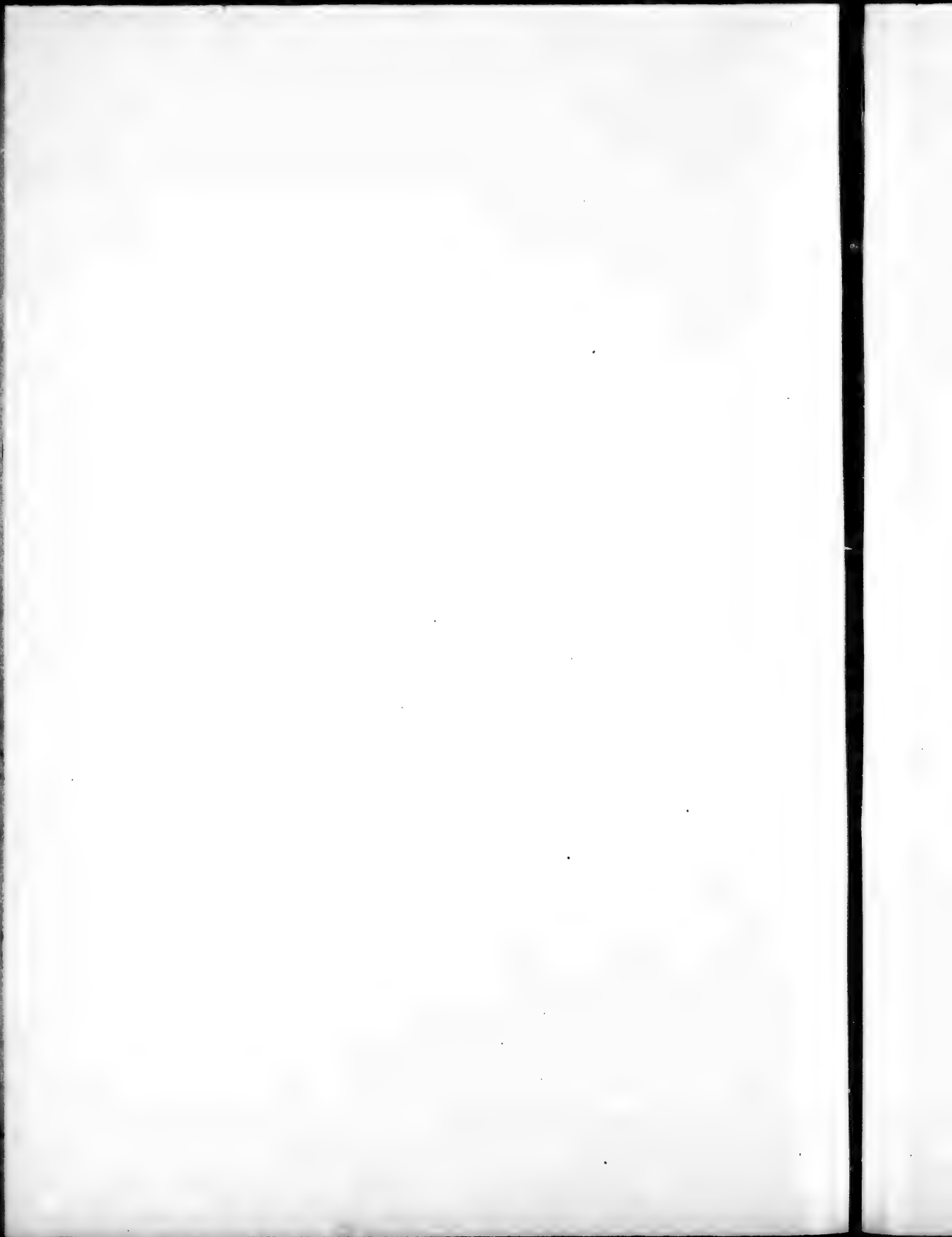
H. Section of the Trunk at the 3rd. Lumbar Vertebra.



I. Section at middle of Femur.

K. Section at middle of Metatarsus.

J. Section at middle of Tibia.



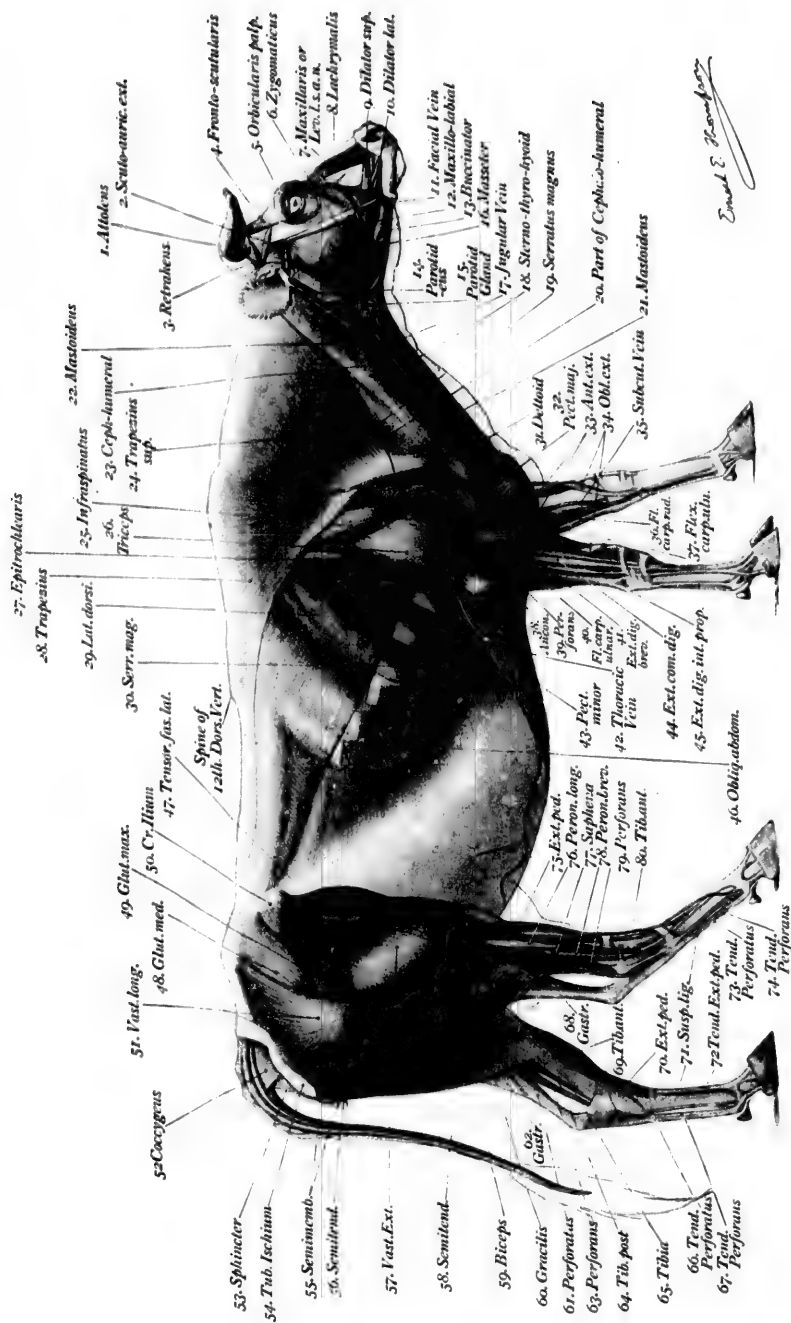


PLATE XXXV.—THE ANATOMY OF THE OX.
 The Fasciculi and Thinner Fascia are removed.



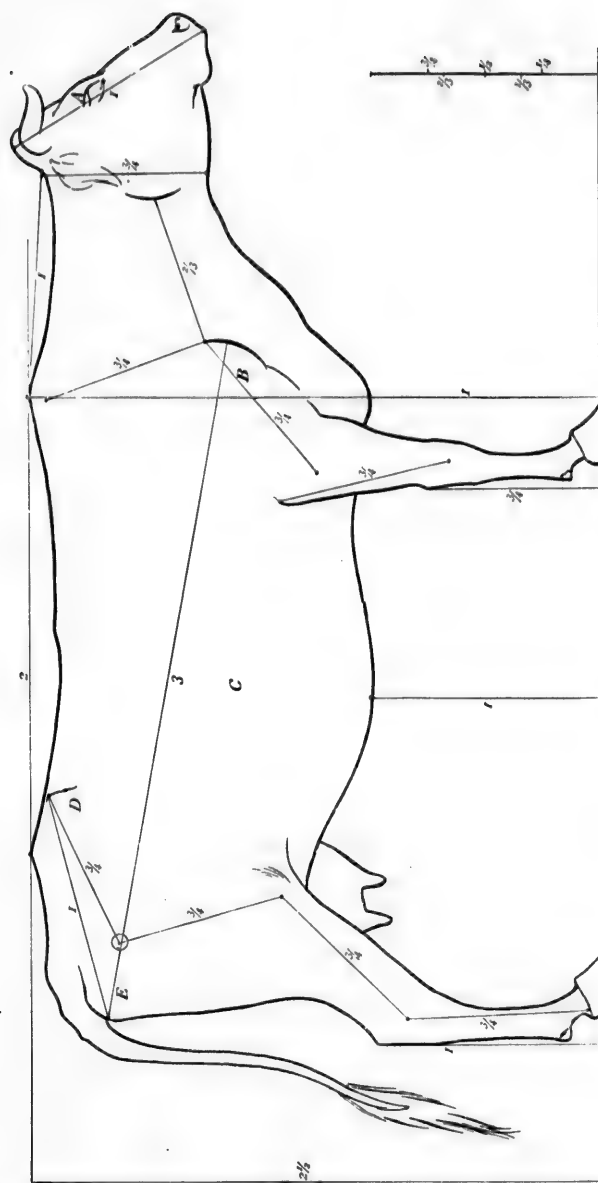


PLATE XXXVI.—THE PROPORTIONS OF THE OX.

In addition to the measurements indicated, the length of the Ear is $\frac{1}{4}$ of a head, so is the width of the Head at the widest part A, $\frac{1}{2}$ of a head; through the Shoulders from Trochanter to Trochanter B = $\frac{1}{2}$ of a head; through the thickest part of the Belly C = $\frac{1}{2}$ of a head; through the extreme outer point of the Iliac crests D = $\frac{1}{2}$ of a head; through the extreme outer point of the Ischium E = $\frac{1}{2}$ of a head.



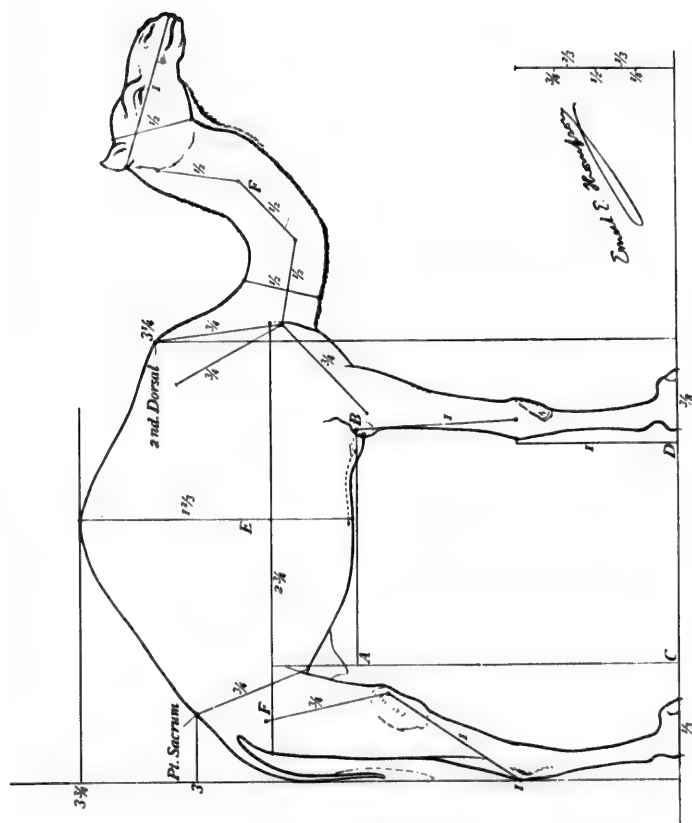
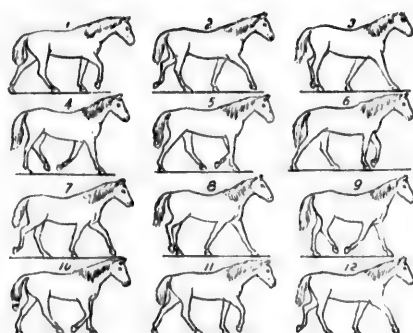


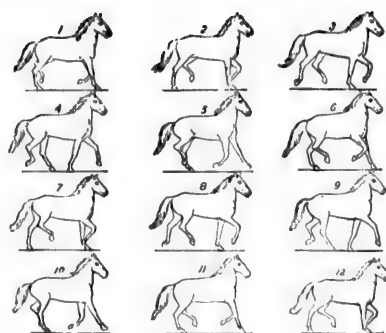
PLATE XXXVIII.—THE PROPORTIONS OF THE DROMEDARY AND THE CAMEL.

The plate represents the Dromedary, but where the proportion is not one of thickness it applies also to the Camel, which is simply a more heavily-built or heavy-draught Dromedary. It will be seen that this animal is higher than long, being $3\frac{1}{2}$ heads high at the Hump, and $2\frac{1}{2}$ long in the Body from Shoulder to Ischium. In addition to the proportions indicated, the width through the orbits of the Eyes is $\frac{1}{2}$ head; the width through the middle of the Neck $F A$ head (the Neck varies but little in width); the width through the Shoulders is $\frac{1}{2}$ head; through the Belly at the widest Point $E A$ head; through the Thighs $A B$ head; the length of the Hind-legs from the Head to the Feet is $2\frac{1}{2}$ heads; the length of the Fore-legs from the Head to the Feet is $1\frac{1}{2}$ heads. If the Hind-legs were advanced to A so that the front line of the Thigh would be straight, then the figure included by the points A B C D would be of exactly the same proportion as the figure of the animal's body.





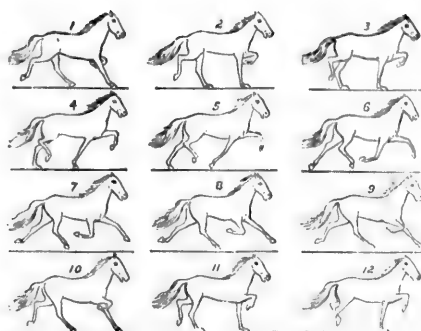
WALK.



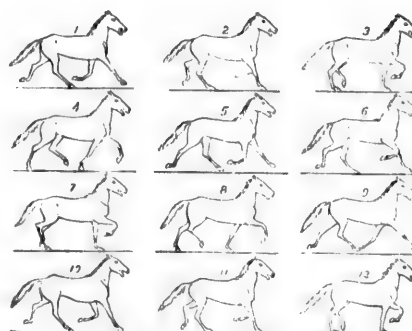
AMBLE.

PLATE XXXIX.—THE HORSE IN MOTION—THE WALK AND THE AMBLE.

From Muybridge photographs.



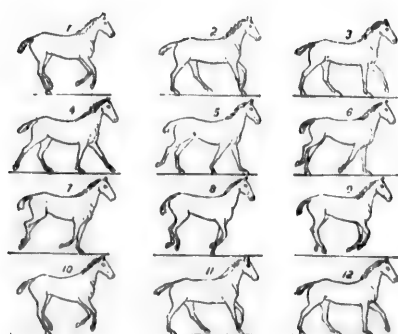
TROT.



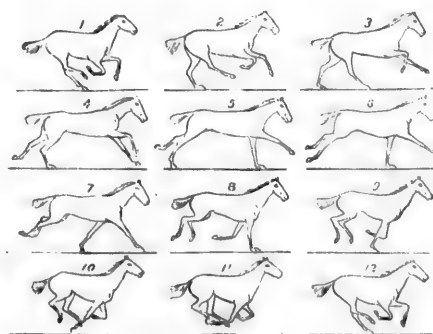
RACK.

PLATE XL.—THE HORSE IN MOTION—THE TROT AND THE RACK.

From Muybridge photographs.



CANTER.



GALLOP.

PLATE XLI.—THE HORSE IN MOTION—THE CANTER AND THE GALLOP.

From Muybridge photographs.

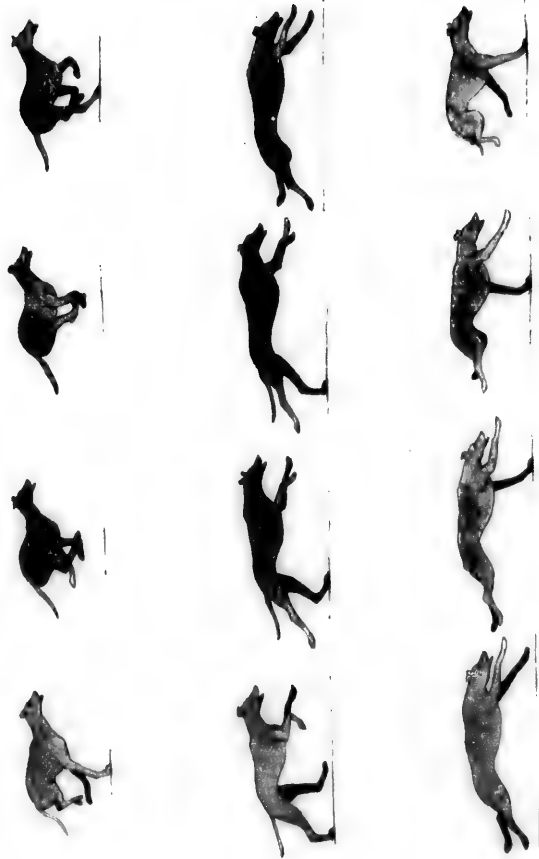
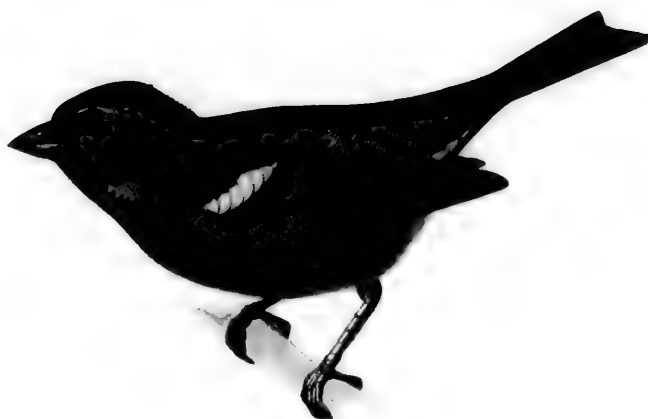
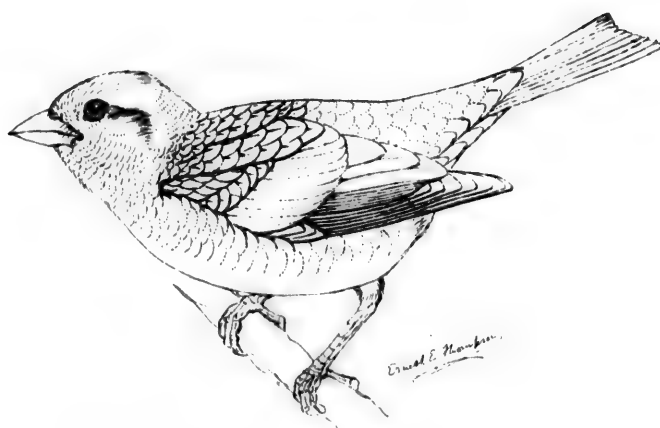


PLATE XLII.—ATTITUDES OF A HOUND RUNNING.
From instantaneous photographs by Muybridge.





A.



B.

PLATE XLIII.—THE COMMON HOUSE OR EUROPEAN SPARROW. (*Passer domesticus*.)

A. The living Bird in good Feather, to show the Pattern.

B. The Anatomy or Arrangement of the Feathering.

This plate will illustrate the Feather arrangement of all the Singing Birds or Passeres. The plate is life-size.



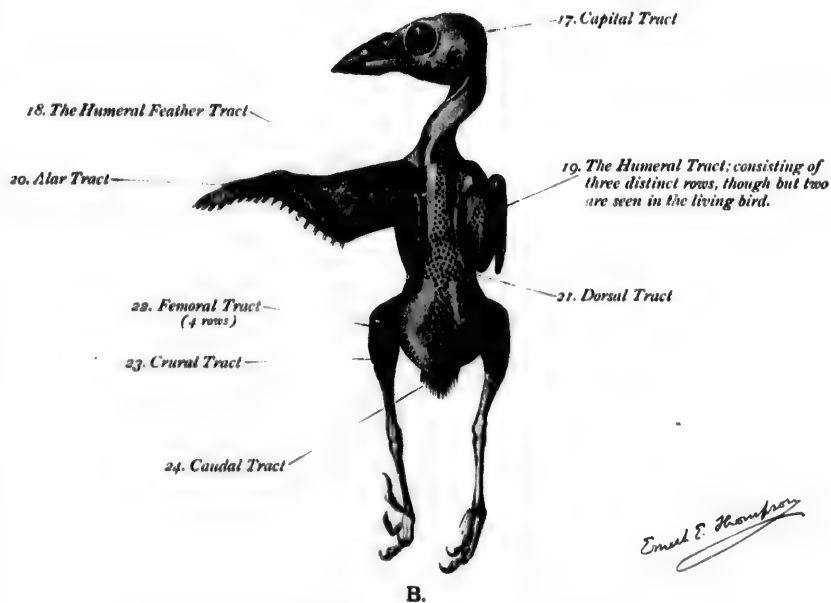
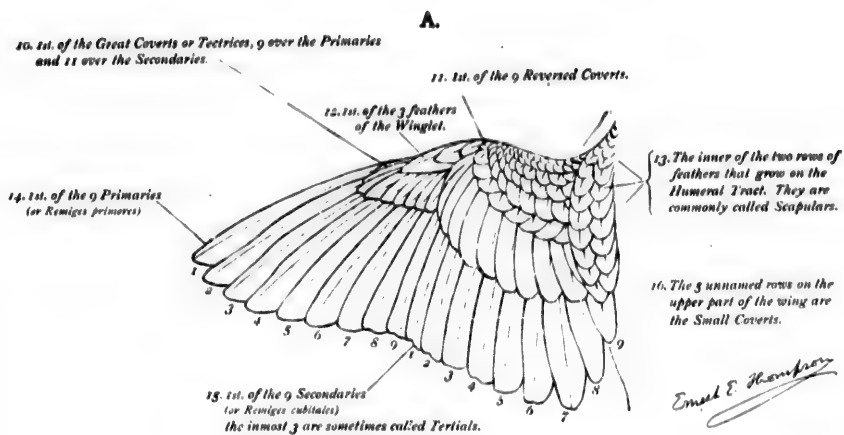


PLATE XLIV.—THE ANATOMY OF THE COMMON OR HOUSE SPARROW.

A. The upper surface of the left Wing, to show the Feather arrangement.

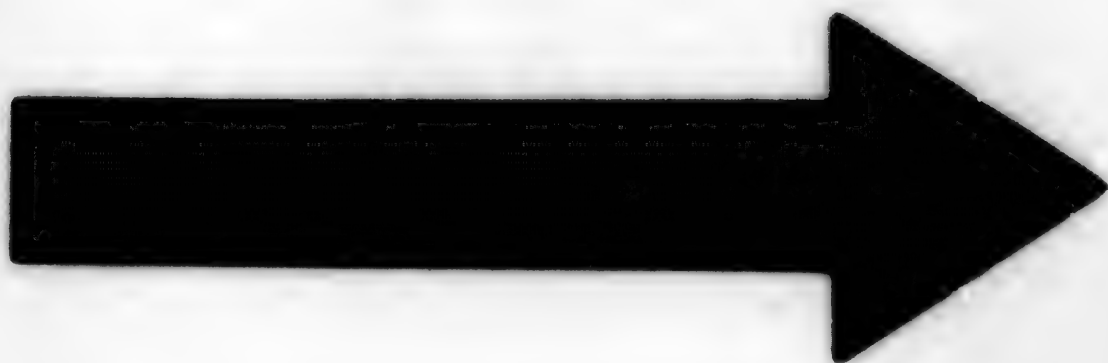
B. The naked Body, to show the Feather tracts and Naked tracts.

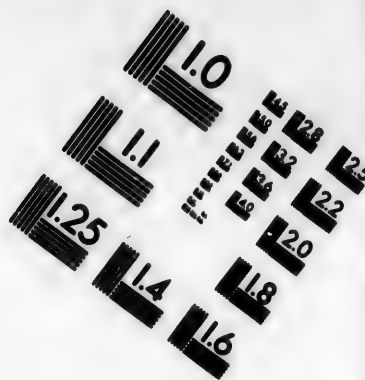
This plate also will illustrate the general features of Feathering in all the Passeres or Singing Birds. This plate is life-size.





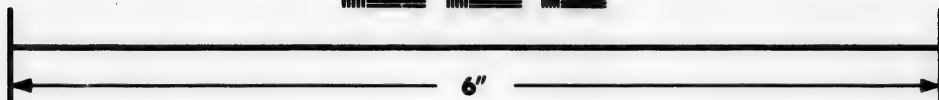
PLATE XLV.—THE EUROPEAN KESTREL. (*Falco alaudarius*.)—Female.
To illustrate the Form and Feather arrangement of the Falcons. The plate is half life-size.





Resolution test chart showing various line patterns and numerical values:

- 1.0
- 1.1
- 1.25
- 1.4
- 1.6
- 1.8
- 2.0
- 2.2
- 2.5
- 2.8
- 3.2
- 3.6
- 4.0
- 4.5
- 5.0
- 5.6
- 6.3
- 7.1
- 8.0
- 9.0
- 10
- 11
- 12.5
- 14
- 16
- 18
- 20
- 22
- 25
- 28
- 32
- 36
- 40
- 45
- 50
- 56
- 63
- 71
- 80
- 90
- 100
- 110
- 125
- 140
- 160
- 180
- 200
- 220
- 250
- 280
- 320
- 360
- 400
- 450
- 500
- 560
- 630
- 710
- 800
- 900
- 1000
- 1100
- 1250
- 1400
- 1600
- 1800
- 2000
- 2200
- 2500
- 2800
- 3200
- 3600
- 4000
- 4500
- 5000
- 5600
- 6300
- 7100
- 8000
- 9000
- 10000
- 11000
- 12500
- 14000
- 16000
- 18000
- 20000
- 22000
- 25000
- 28000
- 32000
- 36000
- 40000
- 45000
- 50000
- 56000
- 63000
- 71000
- 80000
- 90000
- 100000
- 110000
- 125000
- 140000
- 160000
- 180000
- 200000
- 220000
- 250000
- 280000
- 320000
- 360000
- 400000
- 450000
- 500000
- 560000
- 630000
- 710000
- 800000
- 900000
- 1000000
- 1100000
- 1250000
- 1400000
- 1600000
- 1800000
- 2000000
- 2200000
- 2500000
- 2800000
- 3200000
- 3600000
- 4000000
- 4500000
- 5000000
- 5600000
- 6300000
- 7100000
- 8000000
- 9000000
- 10000000
- 11000000
- 12500000
- 14000000
- 16000000
- 18000000
- 20000000
- 22000000
- 25000000
- 28000000
- 32000000
- 36000000
- 40000000
- 45000000
- 50000000
- 56000000
- 63000000
- 71000000
- 80000000
- 90000000
- 100000000
- 110000000
- 125000000
- 140000000
- 160000000
- 180000000
- 200000000
- 220000000
- 250000000
- 280000000
- 320000000
- 360000000
- 400000000
- 450000000
- 500000000
- 560000000
- 630000000
- 710000000
- 800000000
- 900000000
- 1000000000
- 1100000000
- 1250000000
- 1400000000
- 1600000000
- 1800000000
- 2000000000
- 2200000000
- 2500000000
- 2800000000
- 3200000000
- 3600000000
- 4000000000
- 4500000000
- 5000000000
- 5600000000
- 6300000000
- 7100000000
- 8000000000
- 9000000000
- 10000000000
- 11000000000
- 12500000000
- 14000000000
- 16000000000
- 18000000000
- 20000000000
- 22000000000
- 25000000000
- 28000000000
- 32000000000
- 36000000000
- 40000000000
- 45000000000
- 50000000000
- 56000000000
- 63000000000
- 71000000000
- 80000000000
- 90000000000
- 100000000000
- 110000000000
- 125000000000
- 140000000000
- 160000000000
- 180000000000
- 200000000000
- 220000000000
- 250000000000
- 280000000000
- 320000000000
- 360000000000
- 400000000000
- 450000000000
- 500000000000
- 560000000000
- 630000000000
- 710000000000
- 800000000000
- 900000000000
- 1000000000000
- 1100000000000
- 1250000000000
- 1400000000000
- 1600000000000
- 1800000000000
- 2000000000000
- 2200000000000
- 2500000000000
- 2800000000000
- 3200000000000
- 3600000000000
- 4000000000000
- 4500000000000
- 5000000000000
- 5600000000000
- 6300000000000
- 7100000000000
- 8000000000000
- 9000000000000
- 10000000000000
- 11000000000000
- 12500000000000
- 14000000000000
- 16000000000000
- 18000000000000
- 20000000000000
- 22000000000000
- 25000000000000
- 28000000000000
- 32000000000000
- 36000000000000
- 40000000000000
- 45000000000000
- 50000000000000
- 56000000000000
- 63000000000000
- 71000000000000
- 80000000000000
- 90000000000000
- 100000000000000
- 110000000000000
- 125000000000000
- 140000000000000
- 160000000000000
- 180000000000000
- 200000000000000
- 220000000000000
- 250000000000000
- 280000000000000
- 320000000000000
- 36000



Photographic Sciences Corporation

**23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503**

1.0
1.2
1.5
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
7.1
8.0
9.0
10.0
11.2
12.5
14.0
16.0
18.0
20.0
22.0
25.0
28.0
32.0
36.0
40.0
45.0
50.0
56.0
63.0
71.0
80.0
90.0
100.0

1.0
1.2
1.5
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
7.1
8.0
9.0
10.0
11.2
12.5
14.0
16.0
18.0
20.0
22.0
25.0
28.0
32.0
36.0
40.0
45.0
50.0
56.0
63.0
71.0
80.0
90.0
100.0



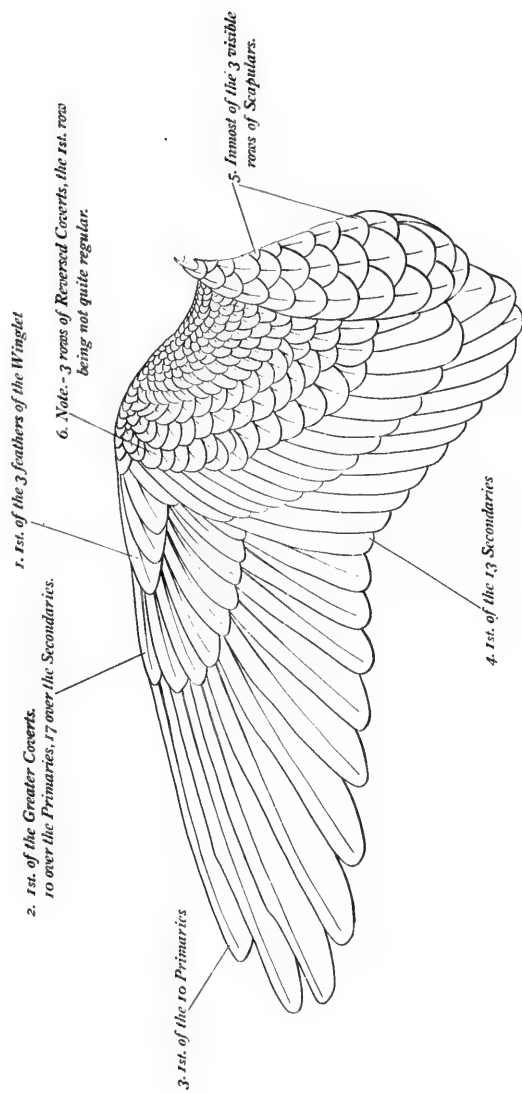
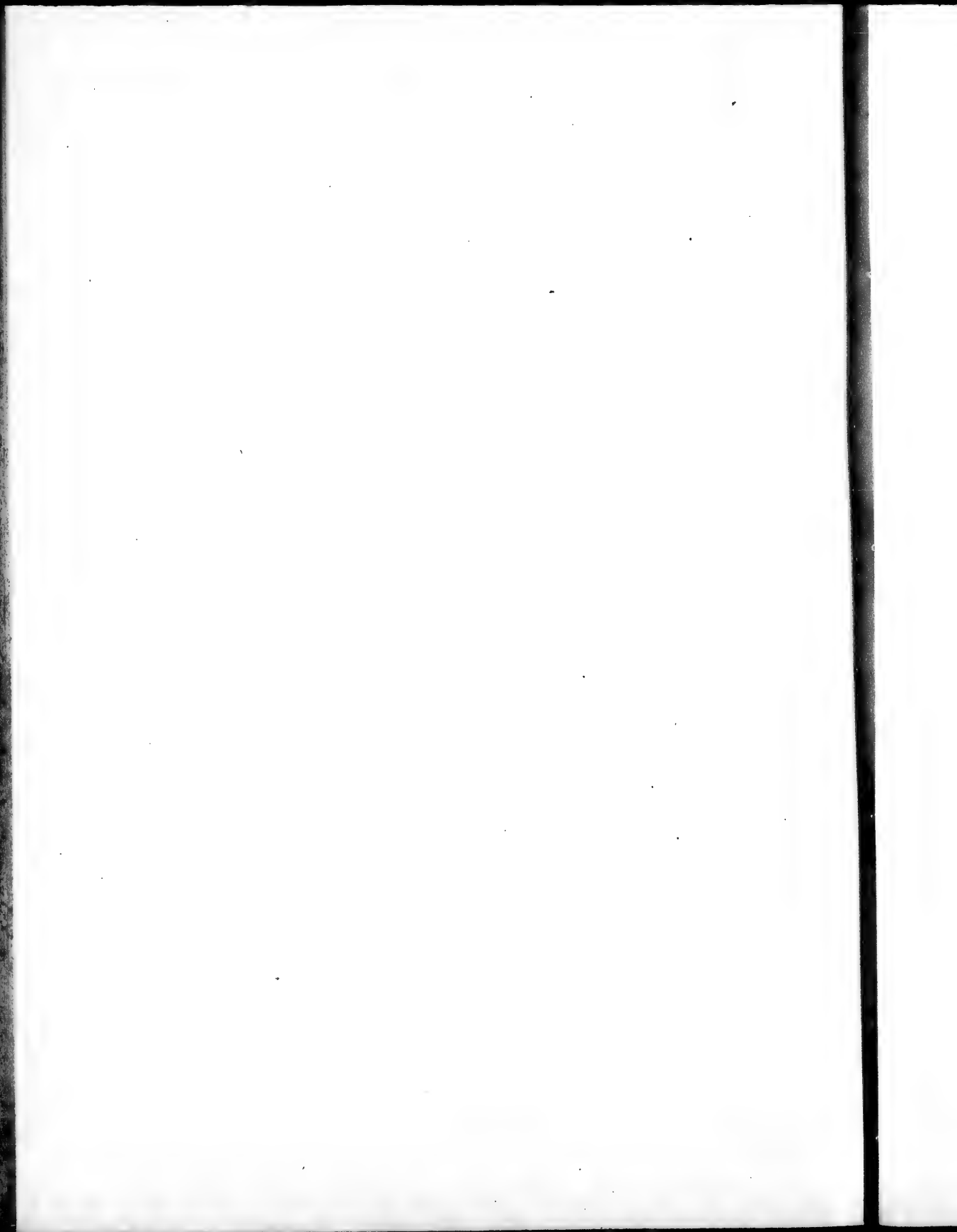


PLATE XLVI.—UPPER SURFACE OF LEFT WING OF EUROPEAN KESTREL.

The plate is half life-size.

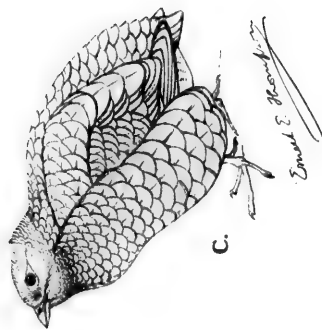




A.



B.



C.

Emmet E. Henry

PLATE XLVII.—THE ANATOMY OF THE COMMON QUAIL OF EUROPE. (*Colinus communis*.)

- A. The living Quail, to show the Pattern produced by the markings when each Feather is perfect and in proper position.
 B. The abstract Form.
 C. The Feathering, to show the various Series.

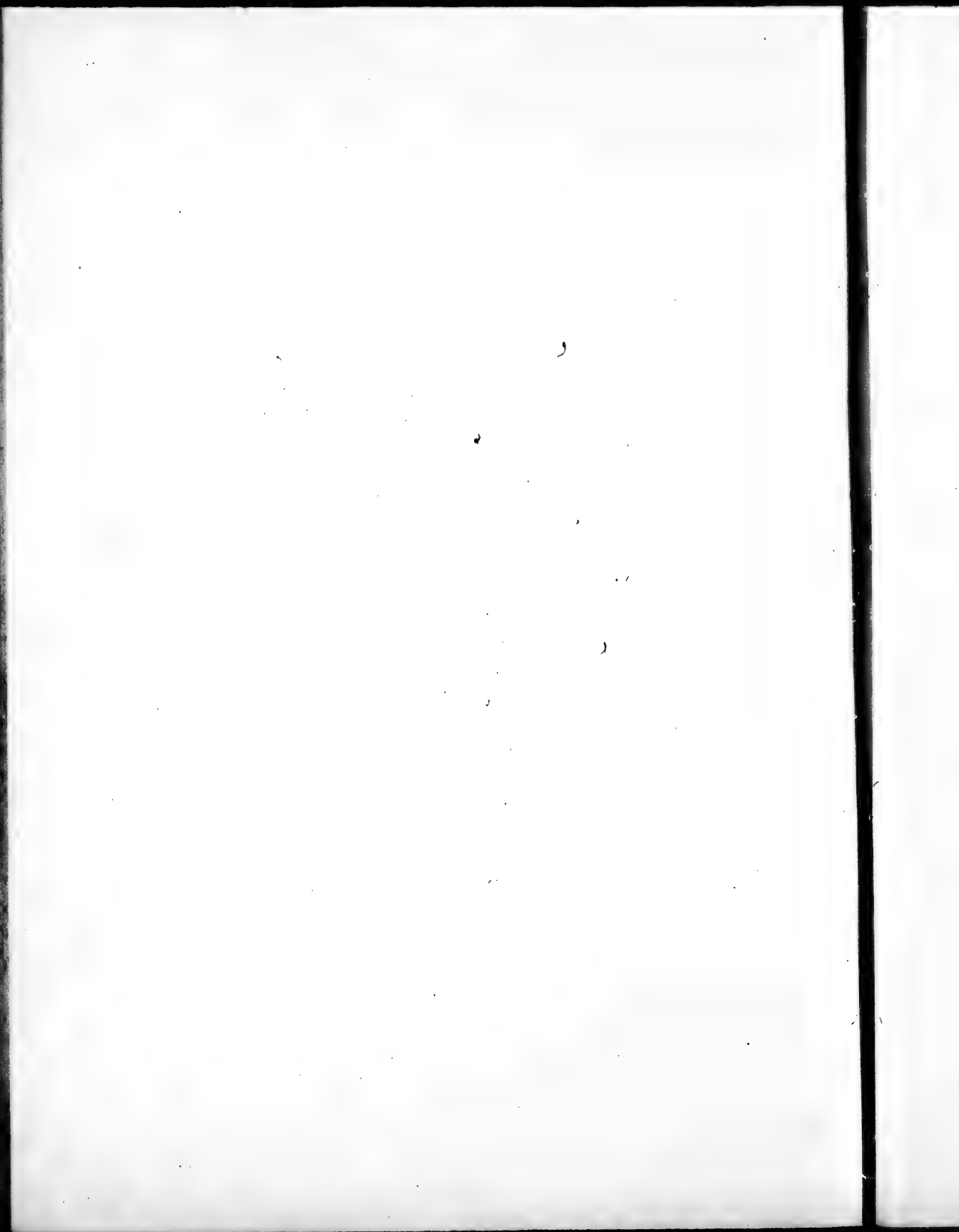


14. Note: 3 half rows and 6 whole rows of Reversed Coverts



PLATE XLVIII.—UPPER SURFACE OF LEFT WING OF COMMON QUAIL OF EUROPE.

The plate is life size.



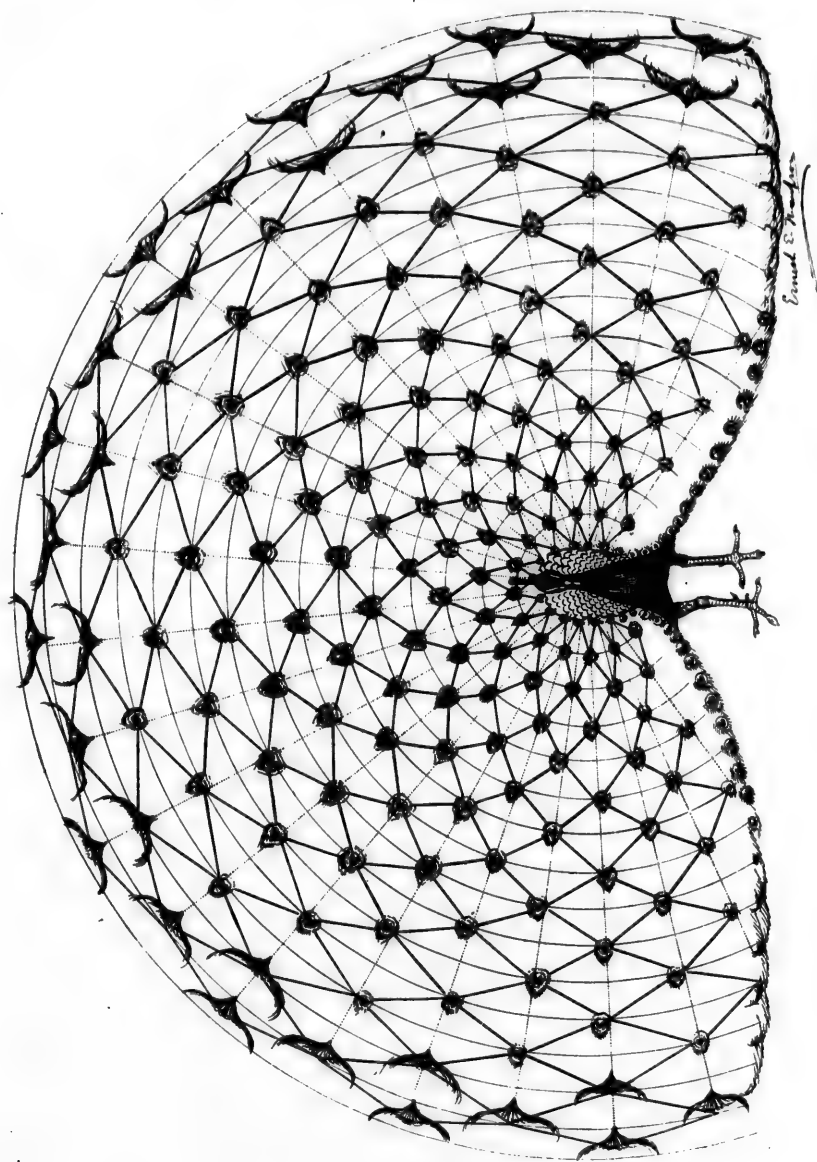


PLATE XLIX. THE PLAN OF A PEACOCK'S TRAIN.

To show the Arrangement when each Feather is present in perfect condition. The plate is $\frac{1}{4}$ of life size.



INDEX

ANATOMY

Anders
Antelope

Antilocapra
Anus, T
Arm, T
Ass, T
A
Auricular

BARYTE

Bear I

Bighorn

Birds

INDEX.

A

- ANATOMY, Art, of Animals, 1**
 of Mammals, chiefly refers to bones, 3
 of Birds, chiefly refers to feathers, *ib.*
 Explanation of visible living Form, *ib.*
 General considerations of, *ib.*
 of Greyhound, adapted to requirements of art anatomists, *ib.*
 Abuse of, 2
 Human, 1
 Professor Anderson on use of, 2
 Professor Cuyler on Barye, *ib.*
 Anderson, Professor, on use of anatomy, *ib.*
 Antelope, The Pronghorned, Anatomy, size and proportions of, 65
 Compared with Giraffe, *ib.*
Antilocapra americana, or Pronghorned Antelope, *ib.*
 Anus, The Muscles of, 30
 Arm, The, Muscles of, 22
 Ass, The, Size and proportions of, 55
 Amble of, 79
 Auricular Sheet, The, 16

B

- BARYE, His methods, 1**
 An advocate of art anatomy, *ib.*
 His opinions on anatomy, 2
 His groups of Lions, 37
 Bear Family, The, 45
 Feet of, *ib.*
 Absence of clavicle in, *ib.*
 American Black, 48
 Proportions of, 45
 Brown, of Europe, 47
 Hair-masses of, 4
 Proportions of, 45
 Life measurements of, *ib.*
 Measurement of Skeleton, 78, 79
 Grizzly, Hair-masses of, 4
 Size of, 46
 Proportions of, 45
 Similarity to Brown Bear, 47
 Measurement of Skeleton, 78, 79
 Polar, Size of, 49
 White, Size of, *ib.*
 Bighorn, The, 61
 Size and proportions of, *ib.*
 Compared with sheep, *ib.*
 Hair like Deer, *ib.*
 Birds, Anatomy of, 3, 82, 83, 84
 Nitsch on the anatomy of, 82
 Feather tracts, or *Pteryla* of, *ib.*
 Naked tracts, or *Apteria* of, *ib.*
 Japanese drawings of, *ib.*

- Birds, Miyōchin Mūncharu, Sculptor of, 82
 Passerine, 84
 Of Prey, *ib.*
 Goodchild on feathers of, 82
 Wolf's drawings of, *ib.*
 Keulemans' drawings of, *ib.*
 Thorburn's drawings of, *ib.*
 Sundevall on wings of, 82, 83, 84
 Bison, The, or American Buffalo, 58, 59
 Measurement of Skeleton, 78, 79
 Bloodhound, The, Skin Folds of, 7
 Body, The, Bones of, 13
 Bones, The, 12
 Of Horse, 50
 Points of contact with skin on Head, 12
 Neck, 13
 Body, *ib.*
 Fore-leg, *ib.*
 Hind-leg, 14
 Buffalo, The American, or Bison, 58
 Size and proportions of, 58, 59
 Measurement of Skeleton, 78, 79
 Bull, Shorthorn, Measurements of, 57
 Skin Folds of, 7

C

- CAIN, Advocate of Art Anatomy, 1**
 Camel, The, Anatomy, size and proportions of, 73
 Pads of, compared to chestnuts or warts on horses, 51
 Bactrian or Two-humped, 73
Canis adusta, or Jackal, 35
latrans, or Coyote, 34
lupus, or Wolf, 33
vulpes, or Fox, 35
Caracus virginianus, or Virginian Deer, 69
 Cat, The, Anatomy, size and proportions of, 36
 Compared with Horse, 50
 Compared with Dog, 36
 Clavicle in, *ib.*
 Cheek, The, Muscles of, 16
 Cheetah, The, Anatomy, size and proportions of, 44
 Chestnuts, or Warts on limbs of Horses, 51
 Chita, The, or Cheetah, 44
Cervus canadensis, or American Elk, 67
elephas, or Red Deer of Europe, 68
 Clavicle, The, or Collar-bone, 36
Coturnix communis, or Common Quail, 84
 Cougar, The, or Puma, 43
 Cow, The, Reversed hair on hind legs of, called "milk-mirror," 5
 Measurement of Skeleton, 78, 79
 Swiss, Measurements of, 57
 Coyote, or Prairie Wolf, size of, &c., 31-34
 Cuvier's Lion, 38
 Cuyler, Professor, On Barye, 2
Cynailurus 'ubatus, or Cheetah, 44

D

- DANE, The Great, Size of, 31
 Da Vinci, Leonardo, Student of surgical anatomy, 1
 Deer Family, The, 66
 Antlers of, *ib.*
 Veins of, 10
 Glands of, 9, 66
 Hair like that of Bighorn, 61
 Proportions of, 66
 Red, The, of Europe, size of, 68
 Miniature of Wapiti, *ib.*
 Proportions of, 66
 Common, The, of America, size of, 69
 Proportions of, 66
 Dew claw, The, or Fifth toe, 31
 Diaphragm, The, 20
 Dog, The, Size and proportions of, 31
 Arrangement of hair of, 6
 Length of head of, 32
 Veins of, 10
 Resembles Fox and Wolf in general anatomy and proportions, 35
 Resembles Cat in anatomy, 36
 Resembles Bears in absence of clavicle, 45
 Gallop of, compared with that of Horse, 81
 Muscles of, compared with those of Horse, 50
 Measurement of Skeleton, 78, 79
 Compared with Ox, 56
 Donkey, The, or Ass, 55
 Amble of, 80
 Dorsal, The Great, 21
 Long, 19
 Dromedary, The, or Saddle Camel, 73

E

- EAR, The, Muscles of Outer, 16
 Elephant, The, Proportions of, 31
 Indian, Size and proportions of, 75
 African, Size of, 77
 Amble of, 80
 Elk, The American, Size of, 67
 Proportions of, 67
 Of Scandinavia, probably same as Moose, 70
 Extensor, The, Lateral of Phalanges, 23
 Anterior of Phalanges, *ib.*
 Anterior of Metacarpus, *ib.*
 Oblique of Metacarpus, 24
 Long, of the Great Toe, 28
 Eyelids, The, Muscles of, 16

F

- Fascia, The, 11
Felis concolor, or Puma, 43
onca, or Jaguar, 41
pardus, or Leopard, 42
 Flexor, The, Long of Arm, 22
 Short of Arm, *ib.*
 Deep of Fingers, 24
 Superficial of Fingers, *ib.*
 Internal of Metacarpus, *ib.*
 Superficial of Phalanges, 28
 Deep of Phalanges, *ib.*
 Oblique of Phalanges, *ib.*
 Square Fleshy, 29
 Flyshaker, The, or *Panniculus carnosus*, 7, 15
 Foot, The Hind Muscles of, 29
 Forearm, The, Muscles of, 23
 Foreleg, The, Bones of, 13
 Fox, The, Anatomy, size and proportions of, 35
 Compared with Wolf and Dog, *ib.*
 Arrangement of hair, 6
 European Red, 35
 American Red, *ib.*
 Foxhound, The, Size of, 31

G

- GERICAULT, Advocate of Art Anatomy, 1
 Gill-cleft, 5
 Giraffe, The, Size and proportions of, 64
 Feet of, resemble those of Antelope, 65
 Glands, The, of Dog, 9
 Goat, *ib.*
 Deer, *ib.*
 Salivary, *ib.*
 Lymph, *ib.*
Gluteus, Deep, 26
 Superficial, *ib.*
 Goat, The, Size and proportions of, 63
 Glands of, 9
 Goodchild, On Birds, 82
 Greyhound, The, Size of, 31
 Muscles of, 15-30
 Arrangement of hair, 4, 5
 Skin Folds of, 7
 Adapted to requirements of Art Anatomist, 3
 Groin-flap, The, or Loose-flank, 7
 Guillaume, M. Eug., On Barye's methods, 1

H

- HAIR, The, Kinds of, 4
 Arrangement of, in man, 6
 Chief masses of, *ib.*
 Of Dogs, *ib.*
 Foxes, *ib.*
 Greyhound, 4, 5
 Grizzly, and Brown Bear, 4
 Horse, *ib.*
 Jackal, 6
 Lion, *ib.*
 Lynx, *ib.*
 Puma, or American Panther, 4
 Small Mammals, *ib.*
 Wolf, 4, 5, 6
 Radiation of, on inside of hind legs of Greyhound, 6
 Cow, called "milk-mirror," 5
 about eyes of American Buffalo, *ib.*
 Several directions of, *ib.*
 Theory of divergence of, *ib.*
 Haunch, The, Muscles of, 26
 Head, The, Bones of, 12
 Muscles of, 15
 Horse, The Anatomy of, 50
 Size and proportions of, 52
 Arrangement of hair, 4
 Bones and Muscles of, 50, 51
 Veins of, 10
 Chestnuts and Warts on limbs of, 51
 Ligamentum nucha in, *ib.*
 Reduction in numbers of muscles and bones of, 50
 Compared with Cat and Dog, *ib.*
 Compared with Ox, 56
 English hunters, 52
 Cavalry, *ib.*
 Of Silene, 54
 Measurement of Skeleton, 78, 79
 Locomotion of, 80
 Walk of, *ib.*
 Amble of, *ib.*
 Trot of, *ib.*
 Rack of, *ib.*
 Canter of, *ib.*
 Gallop of, *ib.*
 Hunting Leopard, The, or Cheetah, 44

I

- INTERTRANSVERSALES, The, 18, 19, 30

JACKAL, The A
 Of Ce
 Arran
 Jaguar, The, S
 Occasi
 Jaw, The, Mu

KESTRAL, Th
 Keulemans, I

LANDSEER, A
 Leech, John,
 Leg, The Hi
 Lower,
 Leopard, The
 Ma
 Sup

Ligaments, T
Ligamentum
 Lion, The A
 Kinds
 Resem
 To esti
 Arrang
 Measu
 Lioness, The
 Mea
 Loose-flank,
 Lynx, The,

MAMMALS :
 Mastiff, The
 Measurmen

Mène, Adv
 Merlin, The
 Ana
 Michael An
 Milk-Mirror
 Miyöchin M
 Moose, The
 Mountain L
 Mouth, The
 Mule, The,
 Muscles, T

J

- JACKAL, The American, or Coyoté, 34
 Of Central Africa, 35
 Arrangement of hair, 6
 Jaguar, The, Size and proportions of, 41
 Occasionally equals Lion in size, *ib.*
 Jaw, The, Muscles of Lower, 17

K

- KESTRAL, The, 84
 Keulemans, His drawings of Birds, 82

L

- LANDSEER, Advocate of Art Anatomy, 1
 Leech, John, on Locomotion of Horses, 80
 Leg, The Hind, Bones of, 14
 Lower, Muscles of, 28
 Leopard, The, Size and proportions of, 42
 May be considered as small Tiger, *ib.*
 Supposed hybrid between Lion and Pard, or Panther, 44
 Ligaments, The, 11
Ligamentum nucha, The, in Horse Family, 51
 Lion, The Anatomy, size and proportions of, 37
 Kinds of, *ib.*
 Resemblance to Cat, *ib.*
 To estimate height of, from Skeleton, 38
 Arrangement of Hair, 6
 Measurement of Skeleton, 78, 79
 Lioness, The, Size and proportions of, 37, 38
 Measurement of Skeleton, 78, 79
 Loose-flank, The, or Groin-flap, 7
 Lynx, The, Arrangement of Hair, 6

M

- MAMMALS: Knowledge of Skeleton necessary, 3
 Mastiff, The, Size of, 31
 Measurements, Full, of Dog, 78, 79
 Lion, *ib.*
 Lioness, *ib.*
 Tiger, *ib.*
 Grizzly Bear, *ib.*
 Brown Bear, *ib.*
 Horse, *ib.*
 Cow, *ib.*
 American Buffalo, *ib.*
 Méne, Advocate of Art Anatomy, 1
 Merlin, The, Wing of, 82
 Anatomy of, *ib.*
 Michael Angelo, Student of Surgical Anatomy, 1
 Milk-Mirror, The, of Cow, 5
 Miyôchin Munéharu, Sculptor of Birds, 82
 Moose, The, Size and proportions of, 70
 Mountain Lion, The, or Puma, 43
 Mouth, The, Muscles of, 16
 Mule, The, Amble of, 80
 Muscles, The, of the Dog, 15
 Horse, 50
 Greyhound, 15
 Skin, *ib.*
 Head, *ib.*
 Mouth and Cheek, 16
 Eyelids, *ib.*
 Outer Ear and Scalp, *ib.*
 Lower Jaw, 17
 Tongue and Throat, *ib.*
 Deep-lying of the Neck, 18
 Prevertebral mass, *ib.*
 Postvertebral mass, *ib.*
 Capital, *ib.*
 Of the Neck, 19
 Trunk, *ib.*
Serratus magnus in Cat Tribe, 20
 Less defined in Dogs and Hoofed Animals, *ib.*

- Muscles, The, Diaphragm, 20
 Inguinal, *ib.*
 Preputial, *ib.*
Scalenus in Cat and Dog, *ib.*
 Of the Shoulder, 22
 Arm, *ib.*
 Forearm, 23
 Deep Flexor, 24
 Radial Palmar, *ib.*
 Ulnar Palmar, *ib.*
Supinator longus, well developed in Cat, wanting in Dog, *ib.*
 Crural, Of the Dog, 27
 Of the Lower Leg, 28
 Paw, 25
 Haunch, 26
 Thigh, 27
 Hind Foot, 29
 Tail, 30
 Anus, *ib.*
Adductor brachii, 22
longus pollicis, 24
minimi digiti, 25
pollicis brevis et opponens pollicis, *ib.*
Adductor indicis, 25, 29
magnus, 28
minimi digiti, 25
pollicis, *ib.*
quinti digiti, 29
Anconeus, 23
brevis, *ib.*
externus, *ib.*
internus, *ib.*
lateralis, *ib.*
longus, *ib.*
medialis, *ib.*
parvus, *ib.*
posticus, *ib.*
quintus, *ib.*
vastus, *ib.*
Angularis, 20
Anterior Extensor of the Metacarpus, 23
Phalanges, *ib.*
Antitragicus, 17
Attollens, 16
Attrahens, *ib.*
Auricularis anterior, *ib.*
posterior, *ib.*
superior, *ib.*
Basio-glossus, 17
Biceps, 22
brachii, *ib.*
femoris, 27
Biventer maxilla inferioris, 17
Brachialis anticus, 22
Buccinator, 16
Bulbo-cavernosus, 30
Brachio-radialis, 24
Caninus, 16
Capsularis, 27
Caput longus, 23
Cephalo-humeral, 21
Cervicalis descendens, 19
Cervico-auricularis, 16
Choanoid, *ib.*
Coccygeus, 30
Complexus major, 19
minor, 18
Coraco-brachialis, 23
-radialis, 22
Corrugator superciliaris medialis, 16
lateralis, *ib.*
Curvator, 30
Deep Flexor of the Fingers, 24
Phalanges, 28
Deep Gluteus, 26
Deltoid, 22
Depressor, 30
concha, 16
labii inferioris, *ib.*
Digastricus, 17

Muscles, *Epicranii*, 17
Epitrochlearis, 23
Erector, 30
 colli, 18
 spinae, 19
Extensor antibrachii longus, 23
 brevis digitorum, 29
 carpi radialis, 23
 carpi ulnaris, 24
 coccygis, 30
 digitorum brevis, 23
 communis, ib.
 lateralis, ib.
 terti, quarti, quinti proprius, ib.
 magnus, ib.
 obliquus, 24
 ossis metacarpi pollicis, ib.
 pedis, 23, 28
 pollicis longus, 28
 pollicis longus et indicis proprius, 24
 suffraginis, 23
External dorso-epitrochlear, ib.
Flexor accessorius, 28
 brevis minimi digiti, 25
 digitorum profundus, 24
 sublimis, ib., 28
 carpi radialis, 24
 ulnaris, ib.
 coccygis, 30
 pedis, 28
 pollicis brevis, 25
Flyshaker, 15
Gastrocnemius, 28
Gemellus, 27
Genio-glossus, 17
Genio-hyoid, ib.
Gluteus maximus, 26
 medius, ib.
 minimus, ib.
Gracilis, 28
Great Dorsal, 21
 Oblique, 20
Helicis, 17
Humeralis externalis, 22
 obliquus, ib.
Hyo-glossus, 17
Ilio-costalis, 19
 spinalis, ib.
Incisivi, 16
Infraspinatus, 22
Intercostales, 20
Internal Flexor of Metacarpus, 24
Interossei, 25, 29
Interspinales, 19
Intertransversales, 18, 19, 30
Ishio-cavernosus, 30
Labialis, 16
Lachrymalis, ib.
Lateral Extensor of Phalanges, 23
Latissimus dorsi, 21
Levator anguli oris, 16
 scapulae, 20
 ani, 30
 auris medius, 16
 labii superioris aequae nasi, ib.
 proprius, ib.
 palpebrae superioris, ib.
 scapulae dorsalis, 21
 ventralis, 20
Levatores costarum, ib.
Lingualis, 17
Long Dorsal, 19
 Extensor of the Great Toe, 28
 Flexor of Arm, 22
Longissimus capitis, 18
 cervicis, 19
 dorsi, ib.
Longus atlantis, 18
 capitis, ib.
 colli, ib.

Muscles, *Lumbricales*, 25, 29
Malaris, 16
Masseter, 17
Mastoides, 21
Mastoido-humeralis, ib.
Maxillaris, 16
Maxillo-labial, ib.
Multifidus spinae, 19
Mylo-hyoid, 17
Nasalis longus, 16
Oblique Extensor of Metacarpus, 24
 Flexor of Phalanges, 28
Obliqui, 16
Obliquus abdominis externus, 20
 internus, ib.
 inferioris, 18
 superioris, ib.
Obturator internus, 26
 externus, ib.
Occipitalis, 17
Occipito-auricularis, 16
Orbicularis oris, ib.
 palpebrarum, ib.
Outer Flexor, 24
Palmaris brevis, 25
 longus, 24
 magnus, ib.
Panniculus carnosus, 15
 cervicis, ib.
Parotideo-auricularis, 16
Parotidens, ib.
Pectineus, 28
Pectoralis profundus or minor, 21
 superficialis or major, ib.
Perforans, 24, 28
Perforatus, ib., ib.
Peroneus brevis, 28
 lateralis, ib.
 longus, ib.
Plantar Flexors, 25, 29
Platysma myoides, 15
Popliteus, 28
Postvertebral mass, 18
Pronator quadratus, 24
 radii teres, ib.
Psoas magnus, 26
 parvus, ib.
Pterygoideus internus and externus, 17
Pyramidalis, 26
Pyrisformis, ib.
Quadriceps extensor cruris, 27
Quadratus femoris, ib.
 labii inferioris, 16
 superioris, ib.
 lumborum, 20
Radialis externus, 23
 internus, 24
 lateralis, 23
 medialis, 24
Recti, 16
Rectus abdominis, 20
 capitis anticus major, 18
 minor, ib.
 posticus major, ib.
 medius, ib.
 minor, ib.
 femoris, 27
 lateralis, 18
Retractor, 16
Retrahens, ib.
Rhomboides, 21
Risorius, 16
 Santorini, ib.
Rotator, ib.
Rotatores spinae, 19
Round Pronator, 24
Sacro-lumbalis, 19
Sartorius, 27
Scalenus, 20
Scutularis, 16

Muscles, *Scutularis*, 16
Semimembranosus, 27
Semispinosus, 27
Semispinosus, 27
Serratus, 27

Short
Small
Sphincter

Spinae

Spino-

Splenius

Squar-

Squar-

Stern-

Stern-

Stylo-

Subili-

Subsc-

Super-

Super-

Supin-

Supr-

Temp-

Tens-

Tenu-

Tere-

Thyr-

Tibio-

Trac-

Trag-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Tran-

Muscles, *Scutulo-auricularis inferior*, or *internus*, 16*Seminembranosus*, 27*Semispinalis*, 19*Semilendinosus*, 27*Serratus anticus*, 19major, *ib.*magnus, *ib.*posticus, *ib.*inferior, *ib.*superior, *ib.*

Short Flexor of Arm, 22

Small Oblique, 20

Sphincter ani, 30

oris, 16

Spinalis, 19dorsi et cervicis or colli, *ib.**Spino-transversalis*, *ib.**Splenius*, *ib.*

Square fleshy flexor, related to the Perforans, 29

Square Pronator, 24

Sternalis, 20

Sterno-cleido-mastoid, 21

hyoid, 17

mastoid, 21

thyroid, 17

Stylo-glossus, *ib.*-hyoid, *ib.*

Sublimis, 24

Subscapularis, 22

Supercarpus, 24

Superficial Flexor of Phalanges, 28

the Fingers, 24

gluteus, 26

Supinator brevis, 24

longus, *ib.*

Supraspinatus, 22

Temporalis, 17

Tensor fasciæ antibrachii, 23

late, 26

vagina femoris, *ib.*

Tenuissimus, 27

Teres major, 22

minor, *ib.*

Thyro-hyoid, 17

Tibialis anticus, 28

posticus, *ib.*

Trachelo-mastoidens, 18

Tragicus major, 17

minor, *ib.*

Transversalis abdominis, 20

capitis, 18

Transverso-spinalis cervicis, *ib.*

Transversus, 17

cervicis, 19

costarum, 20

perinei, 30

Trapezius, 20

Triangularis sterni, *ib.*

Triceps, 23

Ulnaris internus or medialis, 24

Vastus externus, 27

internus, *ib.*

Zygomaticus major, 16

minor, *ib.*

Muybridge, Professor, Ed., His photographs, 80

N

NECK, The, Bones of, 13

Deep-lying Muscles of, 18

Muscles of, 19

Nerves, The, of Dog, 8

Squirrels, *ib.*Nocturnal Quadrupeds, *ib.*Zygomatic, of Greyhound, *ib.*

Newfoundland, The, Size of, 31

O

OBLIQUE, The great, 20

The small, *ib.**Ovis montana*, or Bighorn, 61*polii*, or Pamir Sheep, 62

Owls, Radiation of feathers about eyes of, 5

Ox, The, Anatomy and proportions of, 56

Compared with Dog and Horse, *ib.*

P

PACHYDERMS, Skin Folds of, 7

Panther, The, or Puma, 43

Pard, The, or Panther, 44

Paw, The, Muscles of, 25

Peacock, The, Arrangement of its train, 85

Pheidias, Attained consummation in art, without scientific educa-

tion, 2

Pig, The, Anatomy, size and proportions of, 74

Compared with Ox, *ib.*

Puma, The, Anatomy, size, proportions, and colour of, 43

Q

QUAIL, The Common, 84

R

Rangifer tarandus, or Reindeer, 72

Raphael, Student of surgical anatomy, 1

Reindeer, The, Measurement of Skeleton, 72

Rhinceros, The, Proportions of, 32

Skin Folds of, 7

S

SCALP, The, Muscles of, 16

Scars, Structural, 5

Sheep, The, 60

Compared with Ox, *ib.*Measurements and proportions of, *ib.*

The Pamir, or Polo's, 62

Size and proportions of, *ib.*

Shoulder, The, Muscles, of, 22

Sinews, 11

Skin Folds, The, 7

Of Rhinceros, *ib.*Greyhound, *ib.*Bloodhound, *ib.*Bulls, *ib.*Pachyderms, *ib.*Covering muscular fibres of Flyshaker, *ib.*Forming groin-flap, or loose-flank, *ib.*

Sparrow, The Common, 84

Spizietus, The, Japanese Bronze of, 82

Squirrel, The, Nerves of, 8

Stag, The, or Red Deer of Europe, 68

St. Bernard, The, Size of, 31

T

TAIL, The, Muscles of, 30

Tendons, 11

Thigh, The, Muscles of, 27

Thorburn, His drawings of Birds, 82

Throat, The, Muscles of, 17

Tiger, The, Anatomy and proportions of, 39

Size of, 31, 39

Larger than Lion, 39, 40

Measurement of Skeleton, 78, 79

Tigress, The, Size and proportions of, 40

Tongue, The, Muscles of, 17

Trunk, The, Muscles of, 19

INDEX.

V

VEINS, Maxillary, 5
 Jugular, *ib.*
 Of the Dog, 10
 Horse, *ib.*
 Deer, *ib.*

W

WAPITI, The, or American Elk, 67
 Warts, or Chestnuts, on limbs of Horses, 51
 Wolf, His drawings of Birds, 82
 Wolf, The, Anatomy, size and proportions of, 33, 34

Wolf, The, Arrangement of Hair, 4, 6
 Resembles Dog and Fox in general anatomy and proportions, 35
 Proportions compared with Greyhound, 34
 Identity of Wolves of Old and New Worlds, 33
 American Gray, 34
 Buffalo, 35
 Common, of Europe, 33
 Gray, 33, 35
 Prairie, or Coyoté, 34, 35
 Russian, 33
 Timber, *ib.*
 White, *ib.*
 Yellow, 31
 Wolfhound, The Irish, Size of, 31

anatomy and propor-

34
ids, 33